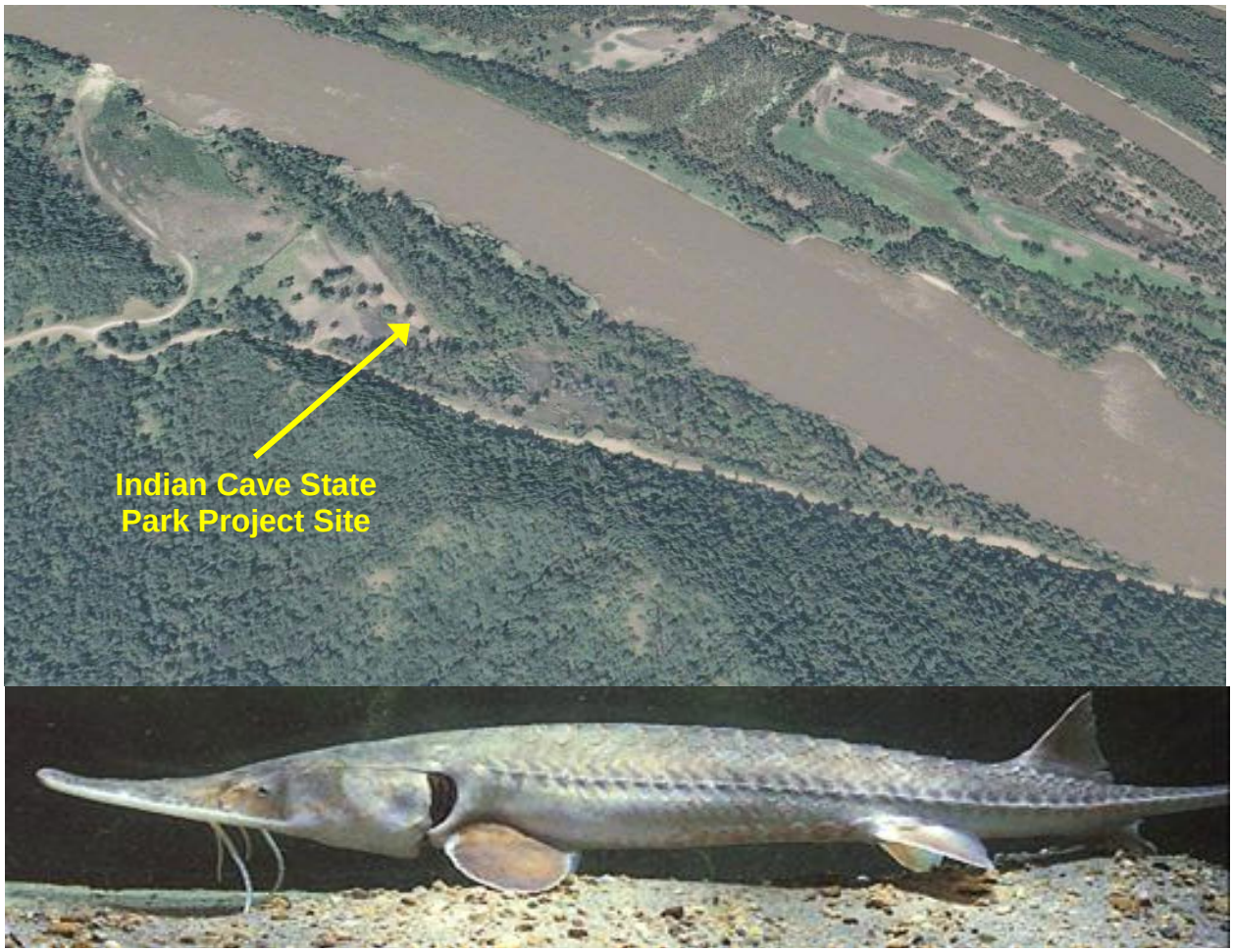
U.S. Army Corps of Engineers
Omaha District

Water Quality Sampling Report and Factual Determinations

Results of Sediment Sampling and Elutriate Testing at the Proposed Indian Cave State Park Shallow Water Habitat Project Site



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Water Quality Sampling Report
and
Factual Determinations

Results of Sediment Sampling and Elutriate Testing at the Proposed Indian Cave State Park Shallow Water Habitat Project Site

Prepared by:

Water Quality Unit
Water Control and Water Quality Section
Hydrologic Engineering Branch
Engineering Division
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U.S. Army Corps of Engineers

August 2013

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1 BACKGROUND INFORMATION

1.1 Project Description

A project is being proposed to construct shallow-water habitat (SWH) along the Missouri River at Indian Cave State Park in Richardson County, Nebraska. The U.S. Army Corps of Engineers (USACE) is constructing SWH along the lower Missouri River downstream of Gavins Point Dam to mitigate aquatic habitat lost from past bank stabilization and channelization, and enhance habitat for the endangered pallid sturgeon (*Scaphirhynchus albus*) population along the lower Missouri River. The Omaha District (District) is referring to the proposed project as the Indian Cave State Park project. Deposited sediment will be excavated at the project site to create a backwater area. Sediment excavation will involve hydraulic dredging with the dredge spoil being discharged to the adjacent Missouri River. It is believed the sediment/soil to be dredged will be primarily alluvial material. An estimated 400,000 cubic yards of sediment/soil would be excavated and discharged to the Missouri River.

1.2 Project Location

The project area is located in Richardson County, Nebraska within Indian Cave State Park along the Lower Deroin Bend of the Missouri River between RM 517 and RM518 (Figure 1). Figure 2 shows the proposed area for excavation to create SWH at the Indian Cave State Park project area.

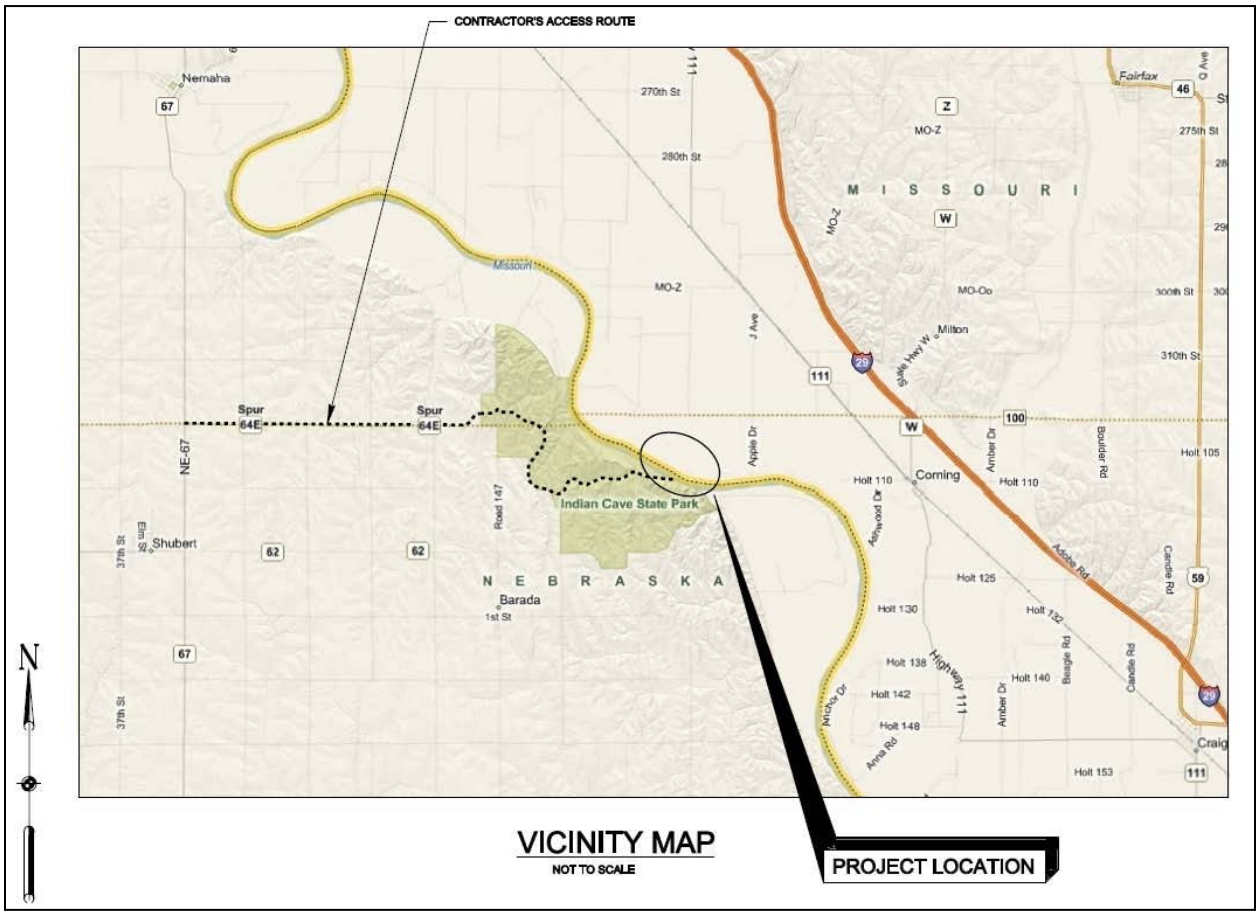

Figure 1. Location of the proposed Indian Cave State Park project site along the Missouri River.

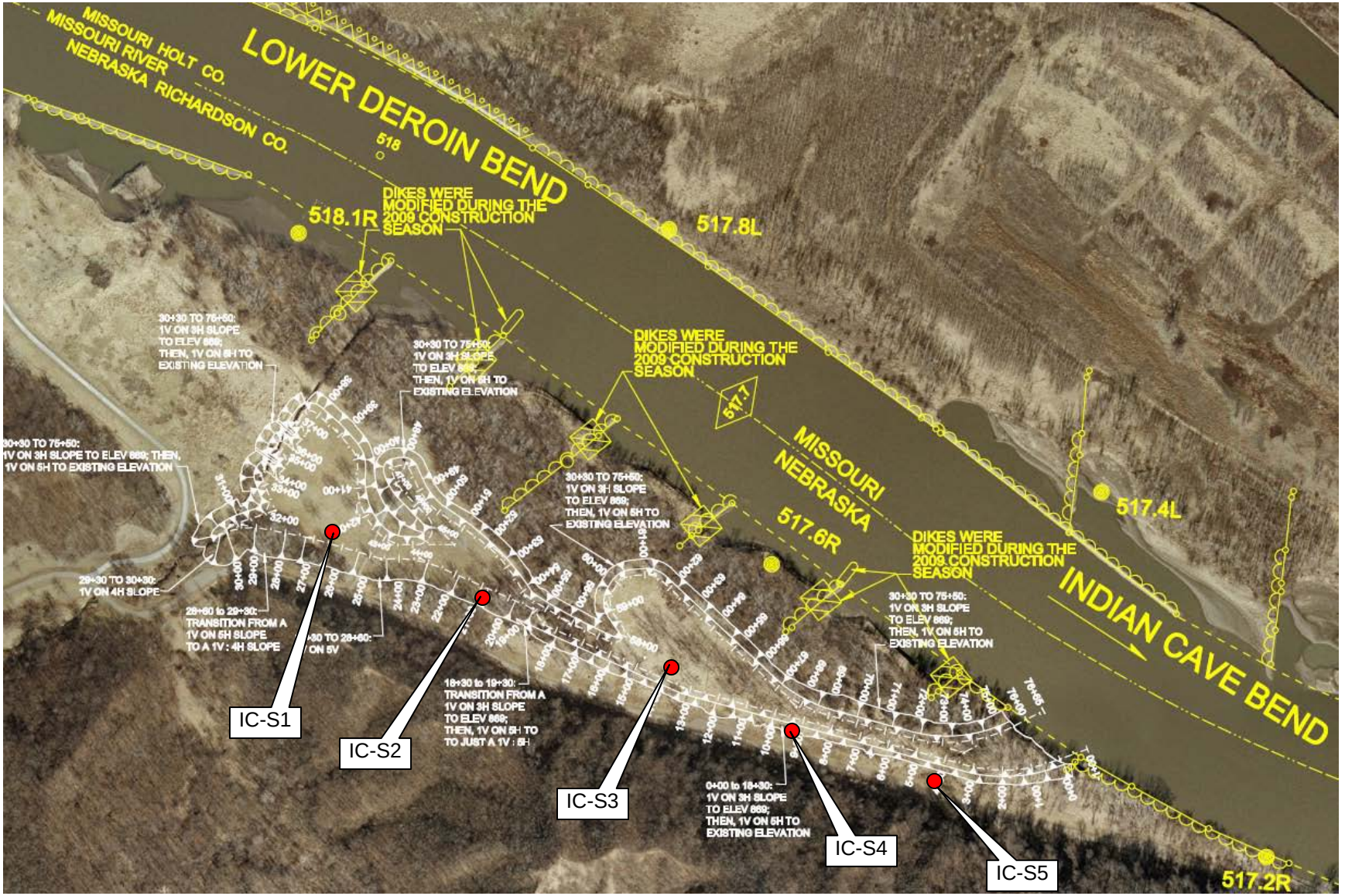

Figure 2. Proposed excavation to create shallow-water habitat at the proposed Indian Cave State Park project area. Locations where sediment/soil samples were collected are shown.

1.3 Section 404 Permitting Requirements – 404(b)(1) Guidelines

Section 404 of the Federal Clean Water Act (CWA) requires that a §404 permit be appropriately obtained prior to the discharge of any dredge or fill material into waters of the United States. The issuance of §404 permits is pursuant to the Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material [40 CFR Ch. I (7-1-10 Edition)]. Fundamental to the 404(b)(1) Guidelines is the precept that dredged or fill material should not be discharged into the aquatic ecosystem, unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact either individually or in combination with known and/or probable impacts of other activities affecting the ecosystems of concern. No discharge of dredged or fill material is permitted: 1) if it will cause or contribute, after consideration of disposal site dilution and dispersion, to violations of any applicable State water quality standard; 2) if it will cause or contribute to significant degradation of the waters of the United States; or 3) unless appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic system.

Compliance with the 404(b)(1) Guidelines is based, in part, on "Factual Determinations" of the potential impact of the proposed dredge and fill on the aquatic environment. The §404 permitting authority is required to determine in writing the potential short-term or long-term effects of a proposed discharge of dredged or fill material on the physical, chemical, and biological components of the aquatic environment. These Factual Determinations are used in making findings of compliance or non-compliance with the restrictions on discharge. The 404(b)(1) Guidelines at §230.11 identify the following eight Factual Determinations that are to be made on the effects of each proposed discharge of dredge and fill material:

1) Physical substrate determinations.
2) Water circulation, fluctuation, and salinity determinations.
3) Suspended particulate/turbidity determinations.
4) Contaminant determinations.
5) Aquatic ecosystem and organism determinations.
6) Proposed disposal site determinations.
7) Determination of cumulative effects on the aquatic ecosystem.
8) Determination of secondary effects on the aquatic ecosystem.

The intent of this report is to provide Factual Determinations of the potential water quality impacts of the proposed hydraulic dredging discharge at the proposed Indian Cave State Park SWH project site on the Missouri River. As defined in the Federal CWA and USACE Regulation No. 1110-2-8154, water quality is defined as the physical, chemical, and biological characteristics of water. This report specifically provides information for water quality Factual Determinations regarding:

- Physical substrate determinations,
- Suspended particulate/turbidity determinations,
- Contaminant determinations,
- Proposed disposal site determinations.

The following describe the Factual Determinations that are to be made pursuant to the 404(b)(1) Guidelines regarding water quality impacts.

1.3.1 Physical Substrate Determinations

Determine the nature and degree of effect that the proposed discharge will have on the characteristics of the substrate at the proposed disposal site. Consideration shall be given to the similarity

in particle size, shape, and degree of compaction of the material proposed for discharge and the material constituting the substrate at the disposal site, and any potential changes in substrate elevation and bottom contours, including changes outside of the disposal site which may occur as a result of erosion, slumpage, or other movement of the discharged material.

1.3.2 Suspended Particulate/Turbidity Determinations

Determine the nature and degree of effect that the proposed discharge will have in terms of potential changes in the kinds and concentrations of suspended particulate/turbidity in the vicinity of the disposal site. Consideration is to be given to the grain size of the material proposed for discharge, the shape and size of the plume of suspended particulates, the duration of the discharge and resulting plume and whether or not the potential changes will cause violations of applicable water quality standards.

1.3.3 Contaminant Determinations

Determine the degree to which the material proposed for discharge will introduce, relocate, or increase contaminants. This determination shall consider the material to be discharged, the aquatic environment at the proposed disposal site, and the availability of contaminants.

1.3.4 Proposed Disposal Site Determinations

The disposal site is specified through the application of the 404(b)(1) Guidelines. The mixing zone associated with the discharge is to be confined to the smallest practicable zone that is consistent with the type of dispersion determined to be appropriate. In a few special cases under unique environmental conditions, where there is adequate justification to show that widespread dispersion by natural means will result in no significantly adverse environmental effects, the discharged material may be intended to be spread naturally in a very thin layer over a large area of the substrate rather than be contained within the disposal site.

1.4 Section 401 Water Quality Certification

Under §401 of the Federal CWA an applicant for a federal license or permit (i.e. §404 permit) must obtain a certification that the discharge and activity is consistent with State or Tribal effluent limitations (CWA §301), water quality related effluent limitations (CWA §302), water quality standards and implementation plans (CWA §303), national standards of performance (§306), toxic and pretreatment effluent standards (CWA §307) and "any other appropriate requirement of State or Tribal law set forth in such certification." Regarding the Indian Cave State Park project, a §401 water quality certification will be requested from the Nebraska Department of Environmental Quality (NDEQ). This report and water quality Factual Determinations will be provided to the NDEQ to appropriately facilitate their water quality certification review pursuant to §401.

1.5 Water Quality Standards Classifications of the Missouri River

1.5.1 Nebraska

The State of Nebraska has designated the following uses to the entire length of the Missouri River in Nebraska: Primary Contact Recreation, Warmwater Aquatic Life Class A, Agricultural Water Supply, and Aesthetics. It has designated the use of public drinking water supply to the river downstream of the confluence of the Niobrara River, and industrial water supply to the river downstream of the confluence of the Big Sioux River. Nebraska has not identified the Missouri River in the vicinity of the Indian Cave State Park project as a National or State Resource Water. As appropriate, Nebraska's antidegradation

policy provides Tier 2 protection (existing water quality) to the Missouri River. Tier 1 protection (existing uses) applies and the State designated beneficial uses must be protected and associated numeric and narrative water quality criteria to protect these beneficial uses are not to be violated.

1.5.2 Missouri

The State of Missouri has designated the following uses to the Missouri River from the Iowa/Missouri State Line to the Kansas River: Aquatic Life Protection, Public Drinking Water Supply, Industrial, Irrigation, Livestock and Wildlife Watering, Secondary Contact Recreation, and Whole Body Contact Recreation. Missouri has not identified the Missouri River in the vicinity of the Indian Cave State Park project as an Outstanding National or State Resource Water. As appropriate, Missouri's antidegradation policy provides Tier 2 protection (existing water quality) to the Missouri River. Tier 1 protection (existing uses) applies and the State designated beneficial uses must be protected and associated numeric and narrative water quality criteria to protect these beneficial uses are not to be violated.

1.6 Use of Sediment/Soil Analysis, Elutriate Testing, and Ambient Missouri River Water Quality Data for Factual Determinations

Factual Determinations regarding potential water quality impacts from the proposed hydraulic dredging to construct SWH at the proposed Indian Cave State Park project was based on the analyses of representative sediment/soil samples collected from the identified excavation area at the proposed project site. The collected sediment/soil samples were also subjected to elutriate testing pursuant to the Inland Testing Manual, "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual (USEPA and USACE, 1998). Historic ambient water quality data collected along the Missouri River by the District were assessed.

2 SITE-SPECIFIC WATER QUALITY CONCERNS

2.1 Fish Consumption Advisory

The State of Nebraska had issued a fish consumption advisory for Dieldrin and PCBs on the Missouri River downstream of Gavins Point Dam. This advisory was based on the analysis of past fish tissue sampling that found levels of these substances at concentrations above the State's defined risk factor for protecting public health via fish consumption. However, the fish consumption advisory has recently been removed based on recent fish tissue sampling (NDEQ, 2012).

2.2 Section 303(d) Impaired Waters Listings

Section 303(d) of the Federal CWA requires States to evaluate water quality conditions in designated waterbodies, and list as impaired (i.e. 303(d) list) any waterbodies not meeting water quality standards. As appropriate, States must develop and implement Total Maximum Daily Loads –TMDLs (i.e. pollutant management plans) for waterbodies identified as impaired.

2.2.1 Missouri

Missouri's water quality standards identify the Missouri River from the IA/MO State Line to the Kansas River as Water Body ID 226.00. This segment is listed on Missouri's 2012 Section 303(d) list as impaired due to *E. coli* bacteria.

2.2.2 Nebraska

Nebraska's water quality standards identify the Missouri River from the Platte River to the NE/KS State Line as designated Segment NE1-10000. Segment NE1-10000 is listed on Nebraska's 2012 Section 303(d) list as impaired due to Bacteria and a fish consumption advisory. The identified parameters of concern are *E. coli* bacteria and Cancer Risk & Hazard Index Compounds, specifically, Dieldrin and PCBs. After the Nebraska Department of Environmental Quality (NDEQ) published their 2012 Integrated Water Quality Report and Section 303(d) list on 1-April-2012 that listed Segment NE1-10000 as impaired due to the fish consumption advisory in effect, the NDEQ published the report, "Findings of the 2010 Regional Ambient Fish Tissue Program in Nebraska" in June, 2012 (NDEQ, 2012). That report indicated that Dieldrin and PCBs were no longer a fish tissue concern on Segment MT1-10000. This resulted in the fish consumption advisory for the Missouri River regarding Dieldrin and PCBs being removed. Based on the removal of the fish consumption advisory for the Missouri River, the NDEQ has indicated that the 303(d) listing of the Missouri River for Dieldrin and PCBs will be removed in the next published 303(d) listing (personal communication NDEQ). As such, the Missouri River in the area of the proposed Indian Cave State Park project site will not be identified as impaired from Cancer Risk & Hazardous Index Compounds (i.e. Dieldrin and PCBs) by Nebraska's next 303(d) list of impaired waters. Personnel communication with NDEQ has indicated that elutriate testing for Dieldrin and PCBs to a detection limit of 0.4 parts-per-trillion is no longer required. A TMDL for *E. coli* bacteria was approved for implementation on Segment NE1-10000 in September 2007.

2.3 Nutrients

2.3.1 Gulf of Mexico Hypoxia

A large area of the northern Gulf of Mexico is experiencing low dissolved oxygen or hypoxia during periods in the summer off the coasts of Louisiana and Texas. The hypoxia is primarily caused by excess nutrients – originating from cities, farms, and industries in the Mississippi River Basin – which cause extensive growths of algae that deplete the oxygen in the water when they die, sink to the bottom, and decompose. The condition is exacerbated by the stratification of the water column – result of warmer, low salinity surface waters that isolate the organic-rich bottom waters from the surface and prevent oxygen exchange with the atmosphere. Nutrient loading reduction targets of 45% of the current total nitrogen and total phosphorus riverine loads have been identified to achieve the goal for hypoxic zone size and to facilitate water quality improvements in the basin (MRGMWNTF, 2008).

The watershed of the Mississippi River drains 41 percent of the contiguous United States and includes waters from several major river systems, including the Missouri/Platte River Basin, the Ohio/Tennessee River Basin, and the Arkansas/Red/White River Basin. The Mississippi River Basin includes two functionally distinct zones, each with its own potential to contribute to Gulf hypoxia. These zones include the huge Mississippi watershed with its tributary network, and at the lower end of the river system, the deltaic zone that formerly dispersed river water naturally throughout Southeast Louisiana via a distributary (deltaic) network. While the tributaries of the Mississippi River are the sources of nutrient loading to the river trunk, the distributaries within the Mississippi Delta are critical to the final dispersal of nutrients and sediments into the Gulf of Mexico and the salinity of the estuaries and coastal waters. During the past two centuries the hydrology of the distributary zone was totally modified by the construction of flood levees, closing of key distributaries for flood control, and navigation enhancement programs. These structures isolated the river from its delta, causing an ongoing catastrophic collapse in the deltaic landscape, primarily wetlands. The hydrologic changes that have caused such damage to South Louisiana also exacerbate Gulf hypoxia by jetting most nutrient-rich river water and sediments directly into the Gulf of Mexico, bypassing the deltaic wetlands that captured the nutrients and sediments.

2.4 National Research Council of the National Academies Assessment of Missouri River Water Quality and Sediment Management

USACE's SWH and emergent sandbar habitat (ESH) projects are directly depositing sediment into the mainstem Missouri River. Concerns have been expressed regarding the potential water quality impacts of those projects downstream and into the northern Gulf of Mexico. The following questions were tasked to the National Research Council regarding water quality and sediment management in the Missouri River:

- *What is the significance of the Missouri River sediments to the Gulf of Mexico hypoxia problem?*
- *What are the key environmental and economic considerations regarding nutrient loads and/or contaminants in Missouri River sediment? To what extent can such issues be addressed with management strategies?*

The following discussion and conclusions are taken from the document, "Missouri River Planning – Recognizing and Incorporating Sediment Management" prepared by the National Research Council (NRC, 2011).

Excess nitrogen loads are responsible for the long-term increase in the hypoxic area in the northern Gulf of Mexico; however, recent studies suggest that phosphorus may also be contributing to hypoxia, especially near the mouths of the Mississippi and Atchafalaya Rivers during the spring. The USACE's construction of SWH projects will result in releases of both nitrogen and phosphorus to the Missouri River because much of the topsoil portion of the sediment disposed of in the river has been heavily fertilized.

The Nation Research Council further assessed the situation based on total nitrogen (TN) and total phosphorus (TP) levels representative of excavated sediment/soil at SWH project sites and current TN and TP loads in the Missouri River and delivered to the Gulf of Mexico. It was concluded that the TN loads from constructed SWH projects will be insignificant compared to the current TN loads transported in the Missouri River and to the Gulf. Phosphorus loadings to the Missouri River from these projects, however, are likely to constitute a much greater fraction of the current load than additional nitrogen loadings. An upper-bound estimate of the increase in TP loadings to the Gulf of Mexico as a result of all potential SWH projects is a 6 to 12 percent increase. This estimate represents an upper bound assuming all sediment is delivered to the Gulf. In reality, sediment deposition processes in the Missouri and lower Mississippi river channels would reduce loads delivered downstream and eventually to the Gulf of Mexico. A comparison of potential phosphorus loads from USACE's SWH projects, with load increments required to produce measurable changes in the areal extent of Gulf hypoxia, showed these projects will not significantly change the extent of the hypoxic area in the Gulf of Mexico.

3 SAMPLING AND ANALYSIS METHODS

Sediment/soil samples, representative of the areas to be excavated for SWH construction at the proposed Indian Cave State Park project site, were collected, analyzed, and subjected to elutriate testing. The results were used to assess the potential water quality impacts that the discharge from hydraulic dredging at the proposed project site would have on the Missouri River. Sediment/soil sampling occurred in May 2011 prior to the onset of the historic 2011 Missouri River flooding and in April 2013 to assess post-2011 flood conditions.

3.1 Sampling and Analysis Plan

Sampling and Analysis Plans (SAPs) were developed to collect sediment/soil samples at the proposed Indian Cave State Park project site in 2011 and 2013 and conduct elutriate testing of the collected samples. The SAPs were developed in consultation with the NDEQ. The SAPs were implemented as written with no modifications and are included as Attachments 1 and 2. The parameters that were measured in the field and analyzed in the laboratory for the collected sediment/soil samples and prepared samples for elutriate testing in 2011 are listed in Table 1. Analytical methods are provided in the attached 2011 SAP (Attachment 1). The parameters that were measured in the field and analyzed in the laboratory for the collected sediment/soil samples and prepared samples for elutriate testing in 2013 are listed in Table 2. Analytical methods are provided in the attached 2013 SAP (Attachment 2).

Table 1. Parameters measured in the field and analyzed in the laboratory for the different media assessed as part of the 2011 sampling at the proposed Indian Cave State Park project site.

Parameter	Sample Analysis		
	Soil	**Receiving Water**	**Elutriate Water**
Field Measurements:			
Water Temperature		✓	
pH		✓	
Dissolved Oxygen		✓	
Specific Conductance		✓	
Turbidity		✓	
Laboratory Analysis:			
Atrazine	✓	✓	✓*
Carbonaceous Biochemical Oxygen Demand - CBOD		✓	✓*
Chemical Oxygen Demand - COD		✓	✓
Nitrogen, Ammonia as N, Total	✓	✓	✓*
Nitrogen, Total Kjeldahl as N	✓	✓	✓*
Nitrogen, Nitrate-Nitrite as N	✓	✓	✓
Organic Carbon, Total - TOC	✓	✓	✓*
Particle Size	✓		
pH	✓	✓	✓
Phosphorus, Dissolved		✓	✓
Phosphorus, Total	✓	✓	✓*
Phosphorus, Orthophosphate		✓	✓
Metals - Total (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc)	✓	✓	✓
Total Suspended Solids		✓	✓*
Turbidity		✓	✓*
Dieldrin	✓	✓	✓*
Polychlorinated Biphenyls – PCBs	✓	✓	✓*
E. coli Bacteria	✓		

***** Determined on supernatant prior to filtration.

Table 2. Parameters measured in the field and analyzed in the laboratory for the different media assessed as part of the 2013 sampling at the proposed Indian Cave State Park project site.

Parameter	Sample Analysis			
	Soil	**Receiving Water**	**Pre-Elutriate Water**	**Elutriate Water**
Field Measurements:				
Water Temperature		✓		
pH		✓		
Dissolved Oxygen		✓		
Specific Conductance		✓		
Turbidity		✓		
Laboratory Analysis:				
Atrazine	✓	✓		✓*
Carbonaceous Biochemical Oxygen Demand - CBOD		✓	✓	✓*
Chemical Oxygen Demand - COD		✓		✓
Nitrogen, Ammonia as N, Total	✓	✓	✓	✓*
Nitrogen, Total Kjeldahl as N	✓	✓	✓	✓*
Nitrogen, Nitrate-Nitrite as N	✓	✓	✓	✓
Organic Carbon, Total - TOC	✓	✓	✓	✓*
Particle Size	✓			
Percent Solids	✓			
Pesticide Scan	✓			
pH	✓	✓		✓
Phosphorus, Dissolved		✓		✓
Phosphorus, Total	✓	✓	✓	✓*
Phosphorus, Orthophosphate		✓		✓
Metals Scan (Dissolved)**		✓		✓
Metals Scan (Total)**			✓	✓*
Metals - Total (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc)	✓			
Organochlorine Pesticide and PCB Scan	✓	✓		✓*
Total Suspended Solids		✓	✓	✓*
Turbidity		✓	✓	✓*
E. coli Bacteria	✓			

***** Determined on supernatant prior to filtration.

** Metals scan includes: Aluminum, Antimony, Arsenic, Beryllium, Cadmium, Calcium, Chromium III, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Nickel, Selenium, Silver, Thallium, and Zinc.

3.2 Collection of Sediment/Soil Samples

Five sediment/soil samples were collected at the proposed Indian Cave State Park project site for *E*. coli bacterial analysis and three sediment/soil samples were collected for elutriate testing on 3-May-2011 and 25-April-2013. The locations where the sediment/soil samples were collected are shown in Figures 2 and 3 and described in Tables 3 and 4. The sediment samples at each of the five sites were collected with a gas-powered auger equipped with a 2-in diameter stainless steel coring bit. Core samples were collected to a depth of 4 feet and composited. In 2013, an additional core sample was collected at site IC-S1 and composted from a depth of 4 to 7 feet. For elutriate testing, 1-gallon of the composited sediment/soil material was collected and transported to the laboratory for analysis.

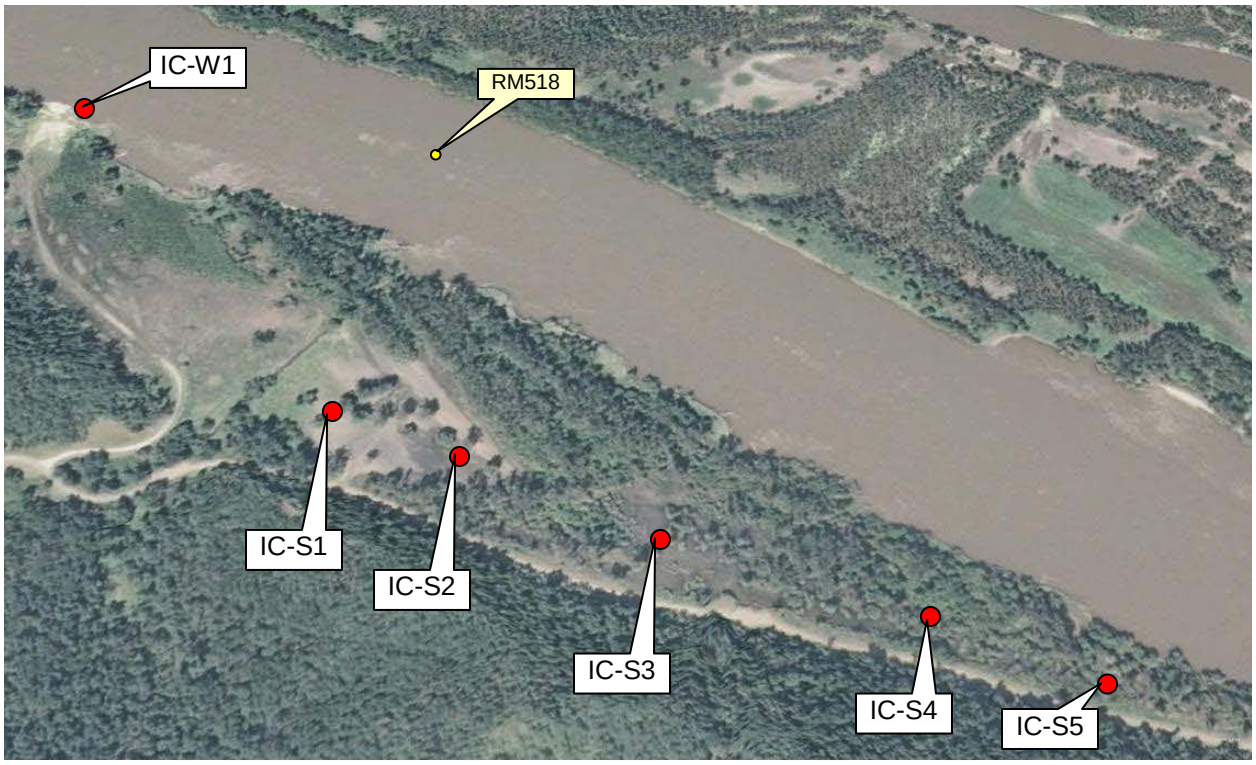

Figure 3. Locations where sediment/soil and receiving water samples were collected at the proposed Indian Cave State Park shallow-water habitat project site on 3-May-2011 and 25-April-2013. *(Site locations shown on 8-July-2010 Google Earth aerial photo of the project area.)*

3.3 Collection of Receiving Water

In accordance with the "*Inland Testing Manual*", receiving water was collected from the Missouri River for elutriate testing. Receiving water measurements and samples were collected from the Missouri River at site IC-W1 at the Indian Cave State Park boat ramp on 3-May-2011 and 25-Apr-2013 (Figure 3). The mean daily flow of the Missouri River at Rulo, NE (RM498) when receiving water samples were collected was 97,200 cfs on 3-May-2011 and 33,400 cfs on 25-April-2013.

Table 3. Sediment/soil samples collected at the proposed Indian Cave State Park shallow-water habitat project site for analysis and elutriate testing

Sample Type	Sample ID	Sample Date	Sampled Depth	Sampling Method
Sediment/Soil	IC-S1	3-May-2011	0 - 4 feet	Composite Core
	IC-S1A	25-April-2013	0 - 4 feet	
	IC-S1B	25-April-2013	4 - 7 feet	
Sediment/Soil	IC-S2	3-May-2011	0 - 1 feet	Composite Core (*E. coli* analysis only)
		25-April-2013		
Sediment/Soil	IC-S3	3-May-2011	0 - 4 feet	Composite Core
		25-April-2013		
Sediment/Soil	IC-S4	3-May-2011	0 - 1 feet	Composite Core (*E. coli* analysis only)
		25-April-2013		
Sediment/Soil	IC-S5	3-May-2011	0 - 4 feet	Composite Core (*E. coli* analysis only in 2013)
		25-April-2013	0 - 1 feet	

Table 4. Geo-referenced locations where sediment/soil samples were collected for analysis and elutriate testing at the proposed Indian Cave State Park shallow-water habitat project site.

Site	Latitude	Longitude
IC-S1	40° 15’ 06.2”	95° 32’ 08.8”
IC-S2	40° 15’ 04.6”	95° 32’ 02.9”
IC-S3	40° 15’ 02.5”	95° 31’ 55.6”
IC-S4	40° 14’ 59.7”	95° 31’ 47.3”
IC-S5	40° 14’ 58.4”	95° 31’ 40.8”

Note: GPS device used for determining locations was Garmin Map 76.

3.4 Elutriate Testing

The process that was used to prepare samples for elutriate testing from the sediment/soil samples collected at the proposed Indian Cave State Park project site in 2013 is depicted in Figure 4. A similar process was used for elutriate testing in 2011 except that no pre-elutriate sample was prepared and analyzed.

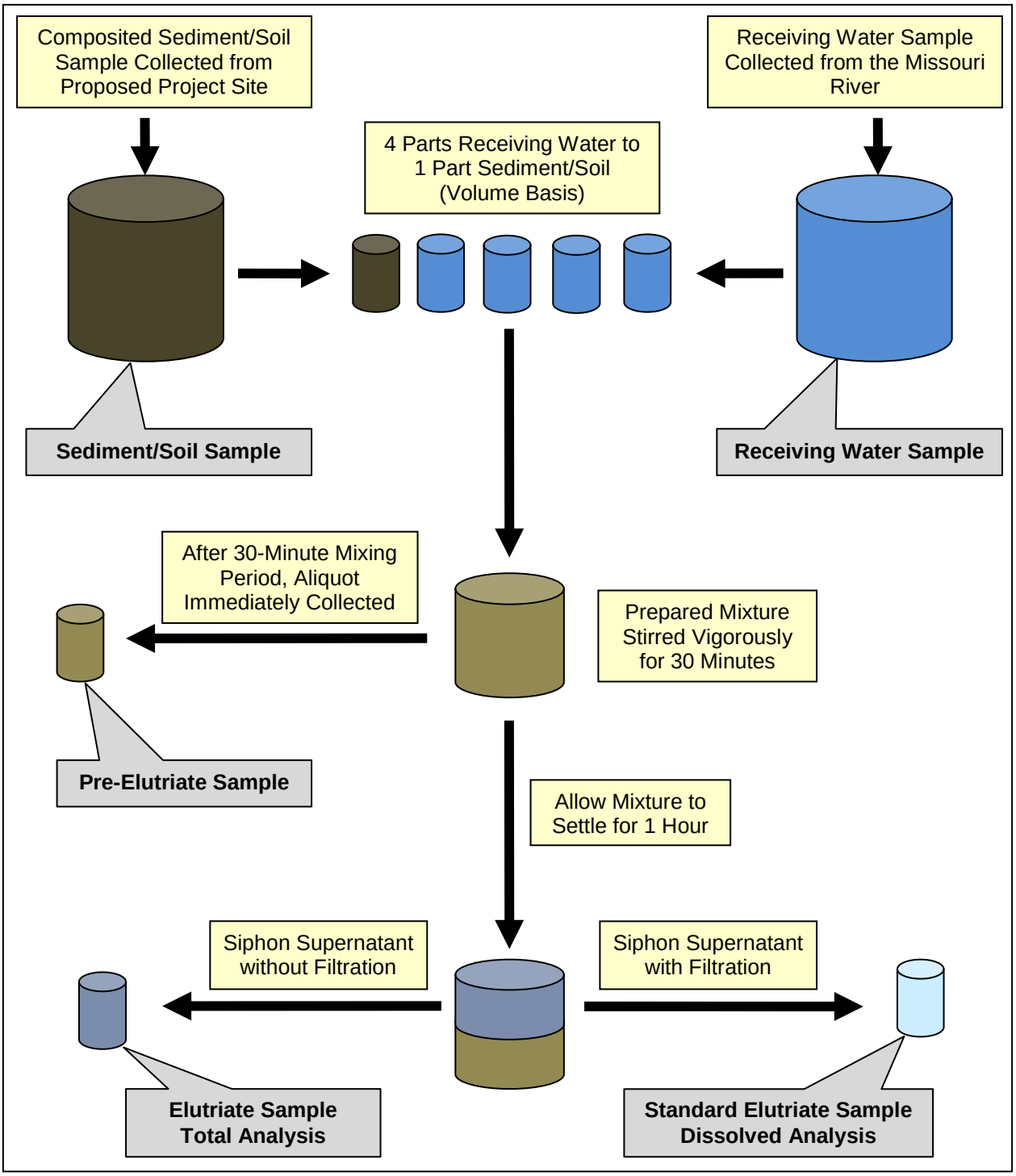

Figure 4. Process used to prepare samples for elutriate testing from sediment/soil samples collected in 2013.

3.4.1 Elutriate Samples

Elutriate samples were prepared in accordance with the "*Inland Testing Manual*", and were prepared by using receiving water collected from the Missouri River at site IC-W1. The samples were prepared in the laboratory by sub-sampling 1-liter of the collected sediment/soil sample from the well-mixed original sample. The sediment material and unfiltered receiving water were then combined in a sediment-to-water ratio of 1:4 on a volume basis at room temperature (22 ± 2°C). The 1:4 sediment-to-water ratio is believed to represent "end-of-pipe" discharge conditions for hydraulic dredging. After the correct ratio was achieved, the mixture was stirred vigorously for 30 minutes with a mechanical stirrer/shaker. After the 30-minute mixing period, the mixture is allowed to settle for one hour. The supernatant was then siphoned off without disturbing the settled material. Analysis for total constituents was done on the supernatant without filtration, and the supernatant was filtered through a 0.45-micron filter for analysis of dissolved constituents. The filtered water is the standard elutriate sample identified by the *"Inland Testing Manual"* and represents the dissolved constituents that could be released from dredged material during the hydraulic dredging process.

3.4.2 Pre-Elutriate Samples

Pre-elutriate samples were prepared for analysis of selected constituents in 2013. The pre-elutriate samples were prepared the same as standard elutriate samples through the point of the 30-minute mixing period. At that time an aliquot of water was immediately drawn off the mixed solution and identified as the pre-elutriate sample. The pre-elutriate sample was analyzed for the following constituents: Total Kjeldahl Nitrogen, Total Ammonia Nitrogen, Total Nitrate-Nitrite Nitrogen, Total Phosphorus, Total Organic Carbon, Total Metals Scan, Total Suspended Solids, Turbidity, and pH. The pre-elutriate sample is believed to represent conditions of the "end-of-pipe" hydraulic dredging discharge slurry prior to any mixing with the receiving water (i.e. Missouri River).

3.4.3 Metal Analysis

The metals Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, and Zinc were identified as parameters of concern by the State of Nebraska. Collected sediment/soil samples were directly analyzed for these metals. Total and dissolved metals scans were run on the collected receiving water and appropriately run on the prepared elutriate samples. Many of Nebraska's water quality standards for metals are hardness based. The District has monitored ambient water quality conditions of the Missouri River at Rulo, NE (RM498) over the 10-year period 2003 through 2012. Based on 31 quarterly measurements, hardness (mg/L) in the Missouri River ranged from 226 to 338, averaged 264, and had a median of 255. The hardness of the receiving water sample collected on 25-Apr-2013 was 279 mg/L.

4 RESULTS

4.1 Receiving Water Field Measurements

The receiving water used for the elutriate testing was collected from the Missouri River at site IC-W1. Water quality conditions of the receiving water measured in the field on 3-May-2011 at the time of collection were: Water Temperature, 12.6°C; Dissolved Oxygen, 10.2 mg/l and 98.0% saturation; pH, 8.8 S.U.; Specific Conductance, 885 µS/cm; and Turbidity, 84 NTU. Water quality conditions of the receiving water measured in the field on 25-Apr-2013 at the time of collection were: Water Temperature, 9.5°C; Dissolved Oxygen, 10.7 mg/l and 96.5% saturation; pH, 7.7 S.U.; Specific Conductance, 727 µS/cm; and Turbidity, 142 NTU.

4.2 Particle Size Analysis

The collected sediment/soil samples used for elutriate testing were analyzed for particle size using Method ASTM D422. The Particle Size Distribution Reports for the analyzed sediment/soil samples collected at sites IC-S1, IC-S3, and IC-S5 in 2011 and sites IC-S1A, IC-S1B, and IC-S3 in 2013 are respectively provided in Attachments 3 and 4. Table 5 and Figure 5 summarize the particle size percent composition of the collected sediment/soil samples. The collected sediment/soil samples ranged from 92.7% to 99.7% fines and 0.3% to 7.3% sand. None of the collected sediment/soil samples contained material of a grain size greater than sand (Table 5).

Table 5. Summary of particle size analysis of the sediment/soil samples collected at the proposed Indian Cave State Park project site in 2011 and 2013.

Sample ID	Date	% Cobbles	% Gravel		% Sand			% Fines	
			Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
IC-S1	3-May-11	0.0	0.0	0.0	0.0	0.1	0.3	72.1	27.5
IC-S1A	25-Apr-13	0.0	0.0	0.0	0.0	0.0	0.4	66.6	33.0
IC-S1B	25-Apr-13	0.0	0.0	0.0	0.0	0.0	0.3	44.2	55.5
IC-S3	3-May-11	0.0	0.0	0.0	0.0	0.0	0.8	61.8	37.4
IC-S3	25-Apr-13	0.0	0.0	0.0	0.0	0.0	7.3	62.3	30.4
IC-S5	3-May-11	0.0	0.0	0.0	0.0	0.1	0.6	58.7	40.6
MEAN		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.6**	**61.0**	**37.4**

See Attachments 3 and 4 for defination of particle sizes.

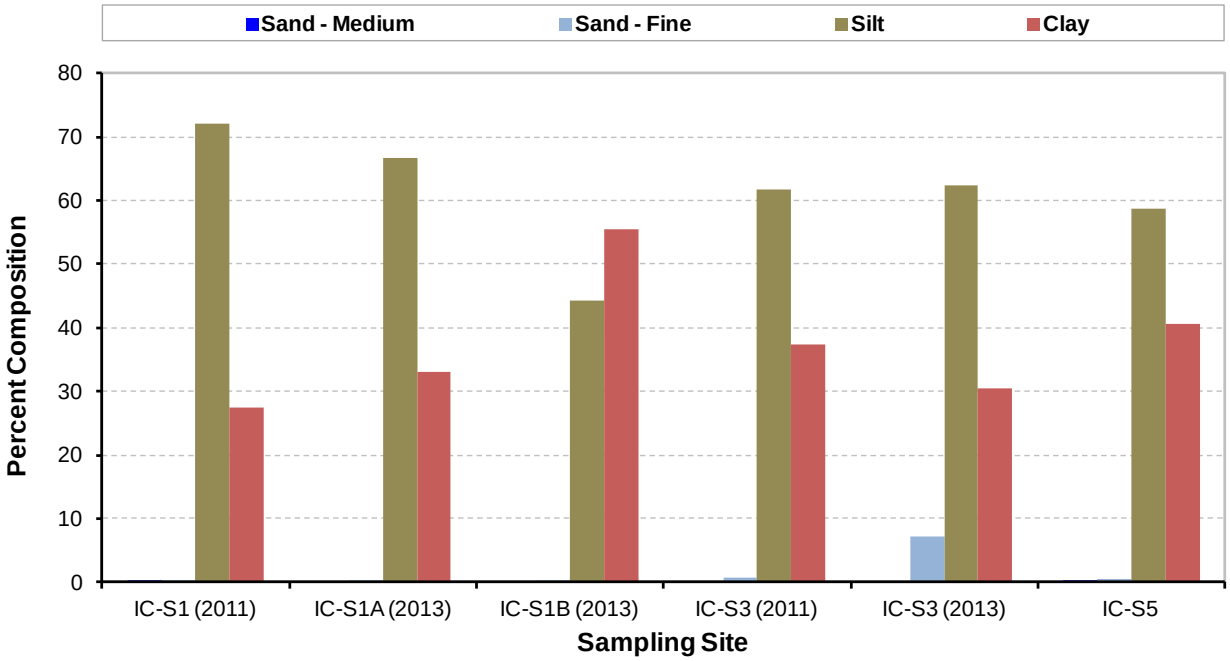

Figure 5. Particle size percent composition of sediment/soil samples collected at sites IC-S1, IC-S3, and IC-S5.

4.3 Bacterial Analysis of Sediment/Soil Samples

Sediment/soil samples collected at sites IC-S1, IC-S2, IC-S3, IC-S4, and IC-S5 were analyzed for *E. coli* bacteria in 2011 and 2013. No detectable levels of *E. coli* bacteria were found in the five sediment/soil samples collected in 2011 and 2013 (Table 6).

Table. 6. *E. coli* bacteria levels found in sediment/soil samples collected at the proposed Indian Cave State Park project site in 2011 and 2013.

Date	Sampling Site				
	IC-S1	**IC-S2**	**IC-S3**	**IC-S4**	**IC-S5**
3-May-2011	n.d.	n.d.	n.d.	n.d.	n.d.
25-Apr-2013	n.d.	n.d.	n.d.	n.d.	n.d.

n.d. = Non-detect (MPN).

4.4 Physiochemical Analysis of Sediment/Soil and Receiving Water Samples and Elutriate Testing Results

The laboratory reports of the analyses of the sediment/soil, receiving water, pre-elutriate, and elutriate samples for 2011 and 2013 are is provided, respectively, in Attachments 5 and 6. The following summarizes these results and their application to Nebraska water quality standards.

4.4.1 Analyzed Constituents with Promulgated State Water Quality Standards

The following constituents were analyzed and have water quality standards criteria promulgated by the State of Nebraska:

- Ammonia Nitrogen
- Atrazine
- Metals
  - Aluminum
  - Antimony
  - Arsenic
  - Beryllium
  - Cadmium
  - Chromium III
  - Copper
  - Iron
  - Lead
  - Manganese
  - Mercury
  - Nickel
  - Selenium
  - Silver
  - Thallium
  - Zinc
- Nitrate-Nitrite Nitrogen
- Organochlorine Pesticides (Scan)
- Polychlorinated Biphenyls – PCBs (Scan)
- pH

4.4.1.1 *Ammonia Nitrogen*

Constituent: Ammonia Nitrogen						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
IC-S1 (2011)	56.8	0.31		-----	0.03J	-----
IC-S1A (2013)	1.9	0.14		< 0.1	0.07J	0.07J
IC-S1B (2013)	1.4	0.14		< 0.1	0.08J	0.07J
IC-S3 (2011)	61.0	0.31		-----	0.08J	-----
IC-S3 (2013)	2.1	0.14		< 0.1	0.05J	0.04J
IC-S5 (2011)	108.0	0.31		-----	0.02J	-----
MEAN (2011)	**75.3**	**-----**		**-----**	**0.04J**	**-----**
MEAN (2013)	**1.8**	**-----**		< 0.1	**0.07J**	**0.06J**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

For application of water quality standards criteria for Ammonia, field measured pH and temperature of the Missouri River when sediment/soil samples collected were 7.7 S.U and 9.5°C, respectively.

Nebraska Water Quality Standards – Ammonia as N; Warmwater Aquatic Life Class A

Constituent	Acute Standard	Chronic Standard
Ammonia (Total as N) *Early Life Stages Present* *pH = 7.7, Temperature (℃) = 9.5*	14.4 mg/L	3.6 mg/L

Comparison of Ammonia Elutriate Tests to Water Quality Standards

All pre-elutriate and non-filtered and filtered elutriate tests of the 2011 and 2013 collected sediment/soil samples at the proposed Indian Cave State Park project site were less than the Nebraska acute and chronic criteria for Ammonia.

Comparison of 2011 and 2013 Sediment/Soil Samples

The 2011 pre-flood sediment/soil samples had appreciably higher measured Ammonia levels than the 2013 post-flood sediment/soil samples at sites IC-S1 and IC-S3.

Comparison of Depth-Discrete Sediment/Soil Samples Collected in 2013 at Site IC-S1

The deeper sediment/soil sample had slightly less measured Ammonia than the shallower sediment/soil sample.

4.4.1.2 *Atrazine*

Constituent: Atrazine						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (μg/L)	Dissolved (μg/L)	Total (μg/L)	Non-Filtered Total Analysis (μg/L)	Filtered Dissolved Analysis (μg/L)
IC-S1 (2011)	< 1	< 1			< 1	
IC-S1A (2013)	< 0.002	0.28J			0.15J	
IC-S1B (2013)	< 0.002	0.28J			0.18J	
IC-S3 (2011)	< 1	< 1			< 1	
IC-S3 (2013)	< 0.002	0.28J			0.15J	
IC-S5 (2011)	< 1	< 1			< 1	
MEAN (2011)	**< 1**	**-----**			**< 1**	
MEAN (2013)	**< 0.002**	**-----**			**0.16J**	

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Atrazine; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard	Chronic Standard	Public Drinking Water Standard
Atrazine	330 μg/L	12 μg/L	3 μg/L

Comparison of Atrazine Elutriate Tests to Water Quality Standards

All non-filtered elutriate tests of the 2011 and 2013 collected sediment/soil samples at the proposed Indian Cave State Park project site were less than the Nebraska acute, chronic, and public drinking water criteria for Atrazine.

Comparison of 2011 and 2013 Sediment/Soil Samples

Both the 2011 pre-flood and 2013 post-flood sediment samples had non-detectable levels of Atrazine at sites IC-S1 and IC-S3.

Comparison of Depth-Discrete Sediment/Soil Samples Collected in 2013 at Site IC-S1

The shallower and deeper sediment/soil samples both had non-detectable levels of Atrazine.

4.4.1.3 *Metals – Aluminum*

Constituent: Metals - Aluminum						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
IC-S1A (2013)		11.97	< 0.03	2,692	4.76	< 0.03
IC-S1B (2013)		11.97	< 0.03	1,329	8.96	< 0.03
IC-S3 (2013)		11.97	< 0.03	2,261	6.29	< 0.03
MEAN (2013)		-----	< 0.03	2,094	6.67	< 0.03

Note: Aluminum was not analyzed in 2011.

NEBRASKA WATER QUALITY STANDARDS – Aluminum; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard (Secondary)
Aluminum	0.750 mg/L	0.087 mg/L	0.2 mg/L

Comparison of Aluminum Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 2013 sediment/soil samples were less than the acute and chronic Warmwater Aquatic Life Class A criteria for Aluminum. The non-filtered elutriate tests exceeded the 0.2 mg/l public drinking water standard. However, Nebraska's water quality standards qualify the application of numerical criteria for public drinking water as follows:

> *"If the natural background level of a parameter is greater than the numerical standard, this shall not in and of itself prohibit the use of the surface water. If the natural background level of a parameter is greater than the numerical standard listed below, the background level shall be used in place of the numerical criteria."*

Ambient water quality concentrations for total Aluminum in the Missouri River exceed the 0.2 mg/L public drinking water standard – the measured total Aluminum concentration of the collected receiving water was 11.97 mg/L. The non-filtered total analysis elutriate testing results were less than the total Aluminum levels measured in the collected Missouri River receiving water.

4.4.1.4 *Metals – Antimony*

Constituent: Metals - Antimony						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
IC-S1A (2013)		0.6	1.2	0.9J	< 0.03	1.3
IC-S1B (2013)		0.6	1.2	<0.2	< 0.03	0.7J
IC-S3 (2013)		0.6	1.2	0.4J	< 0.03	0.7J
MEAN (2013)		-----	-----	0.5J	< 0.03	0.9J

Note: Antimony was not analyzed in 2011.

Note1: The Antimony results are near detection limits and exhibit obvious measurement error (e.g. filtered results higher than non-filtered results).

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Antimony; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard	Chronic Standard	Public Drinking Water Standard
Antimony	88 µg/L	30 µg/L	5.6 µg/L

Comparison of Antimony Elutriate Tests to Water Quality Standards

All non-filtered and filtered elutriate tests of the 2013 sediment/soil samples were less than the acute and chronic Warmwater Aquatic Life Class A and the Public Drinking Water standard.

4.4.1.5 *Metals – Arsenic*

Constituent: Metals - Arsenic							
			Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location		Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
IC-S1	(2011)	1.4	-----	2.0J	-----	-----	< 1.0
IC-S1A	(2013)	6.6	6.0	< 0.3	1,060	0.9J	< 0.3
IC-S1B	(2013)	10.4	6.0	< 0.3	669	3.0	< 0.3
IC-S3	(2011)	< 1.0	-----	2.0J	-----	-----	< 1.0
IC-S3	(2013)	7.1	6.0	< 0.3	919	1.0	< 0.3
IC-S5	(2011)	< 1.0	-----	2.0J	-----	-----	< 1.0
MEAN	**(2011)**	**< 1.0**	**-----**	**-----**	**-----**	**-----**	**< 1.0**
MEAN	**(2013)**	**8.0**	**-----**	**-----**	**883**	**1.6**	**< 0.3**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Arsenic; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Arsenic	340 µg/L	16.7 µg/L	10 µg/L

Comparison of Arsenic Elutriate Tests to Water Quality Standards

The filtered elutriate tests (dissolved) for Arsenic were non-detect for all the 2011 and 2013 analyses and below the acute and chronic criteria for Aquatic Life Class A. The non-filtered elutriate tests (total) for Arsenic were below the Public Drinking Water Standard.

Reflective of the higher Arsenic levels analyzed in the sediment/soil samples in 2013, the 2013 pre-elutriate samples for total Arsenic were also high. This could represent an "end-of-pipe" concern for total Arsenic regarding public drinking water. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by the non-filtered and filtered elutriate testing, Arsenic levels (total and dissolved) are less than the 10 µg/L Public Drinking Water Standard after settling and filtration. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Indian Cave State Park project site.

Comparison of 2011 and 2013 Sediment/Soil Samples

The 2011 pre-flood sediment samples had appreciably lower measured Arsenic levels than the 2013 post-flood sediment samples at sites IC-S1 and IC-S3.

Comparison of Depth-Discrete Sediment/Soil Samples Collected in 2013 at Site IC-S1

The deeper sediment/soil sample had a higher measured Arsenic level than the shallower sediment/soil sample.

4.4.1.6 *Metals – Beryllium*

Constituent: Metals - Beryllium						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (μg/L)	Dissolved (μg/L)	Total (μg/L)	Non-Filtered Total Analysis (μg/L)	Filtered Dissolved Analysis (μg/L)
IC-S1A (2013)		0.4J	< 0.4	122	< 0.4	1J
IC-S1B (2013)		0.4J	< 0.4	61	< 0.4	< 0.4
IC-S3 (2013)		0.4J	< 0.4	102	< 0.4	< 0.4
MEAN (2013)		**-----**	**-----**	**95**	**< 0.4**	**0.5**

Note: Beryllium was not analyzed in 2011.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Beryllium; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Beryllium	130 μg/L	5.3 μg/L	4 μg/L

Comparison of Beryllium Elutriate Tests to Water Quality Standards

All filtered elutriate tests (dissolved) of the 2013 analysis for Beryllium were below the acute and chronic criteria for Aquatic Life Class A. The non-filtered elutriate tests (total) for Beryllium were below the Public Drinking Water standard.

The 2013 pre-elutriate samples for total Beryllium were elevated. This could represent an "end-of-pipe" concern for total Beryllium regarding public drinking water. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by the non-filtered and filtered elutriate testing, Beryllium levels (total and dissolved) are less than the 4 μg/L Public Drinking Water Standard after settling and filtration. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Indian Cave State Park project site.

4.4.1.7 *Metals – Cadmium*

Constituent: Metals - Cadmium							
			Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location		Sediment/Soil (mg/kg)	Total (μg/L)	Dissolved (μg/L)	Total (μg/L)	Non-Filtered Total Analysis (μg/L)	Filtered Dissolved Analysis (μg/L)
IC-S1	(2011)	1.27	-----	< 0.2	-----	-----	< 0.2
IC-S1A	(2013)	0.37	0.6	0.5	76.9	0.3J	0.6J
IC-S1B	(2013)	0.48	0.6	0.5	29.4	0.3J	0.5J
IC-S3	(2011)	1.38	-----	< 0.2	-----	-----	< 0.2
IC-S3	(2013)	0.45	0.6	0.5	71.5	0.4J	0.5J
IC-S5	(2011)	1.84	-----	< 0.2	-----	-----	< 0.2
MEAN	**(2011)**	**1.50**	-----	-----	-----	---	**< 0.2**
MEAN	**(2013)**	**0.43**	-----	-----	**59.3**	**0.3J**	**0.5J**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Cadmium; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Cadmium *Hardness = 264 mg/L*	15 μg/L	0.5 μg/L	5 μg/L

Comparison of Cadmium Elutriate Tests to Water Quality Standards

The filtered elutriate tests (dissolved) for Cadmium for all the 2011 and 2013 analyses were below the acute criterion for Aquatic Life Class A. The 2011 filtered elutriate tests were also below the chronic criterion for Cadmium, and the 2013 filtered elutriate tests were right at the Cadmium chronic criterion. The 2013 non-filtered elutriate tests (total) for Cadmium were below the Public Drinking Water Standard.

The 2013 pre-elutriate samples for total Cadmium were elevated. This could represent an "end-of-pipe" concern for total Cadmium regarding public drinking water. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by the non-filtered and filtered elutriate testing, Cadmium levels (total and dissolved) are less than the 5 μg/L Public Drinking Water standard after settling and filtration. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Indian Cave State Park project site.

Comparison of 2011 and 2013 Sediment/Soil Samples

The 2011 pre-flood sediment samples had somewhat higher measured Cadmium levels than the 2013 post-flood sediment samples at sites IC-S1 and IC-S3.

Comparison of Depth-Discrete Sediment/Soil Samples Collected in 2013 at Site IC-S1

The depth-discrete sediment/soil samples had similar measured Cadmium levels.

4.4.1.8 *Metals – Chromium III*

Constituent: Metals – Chromium III							
			Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location		Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
IC-S1	(2011)	16.8	-----	< 1	-----	-----	< 1
IC-S1A	(2013)	19.8	10	< 2	3,440	3J	< 2
IC-S1B	(2013)	21.2	10	< 2	1,660	8J	< 2
IC-S3	(2011)	17.5	-----	< 1	-----	-----	3J
IC-S3	(2013)	20.3	10	< 2	2,660	5J	< 2
IC-S5	(2011)	21.6	-----	< 1	-----	-----	< 1
MEAN	**(2011)**	18.6	-----	-----	-----	-----	2J
MEAN	**(2013)**	20.4	-----	-----	2,587	5J	< 2

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Chromium III; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Chromium III *Hardness = 264 mg/L*	1,311 µg/L	171 µg/L	100 µg/L

Comparison of Chromium III Elutriate Tests to Water Quality Standards

The filtered elutriate tests (dissolved) for Chromium III for all the 2011 and 2013 analyses were below the acute and chronic criteria for Aquatic Life Class A. The 2013 non-filtered elutriate tests (total) for Chromium III were below the Public Drinking Water Standard.

The 2013 pre-elutriate samples for total Chromium were elevated. This could represent an "end-of-pipe" concern for total Chromium III regarding public drinking water. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by the non-filtered and filtered elutriate testing, Chromium III levels (total and dissolved) are less than the 100 µg/L Public Drinking Water standard after settling and filtration. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Indian Cave State Park project site.

Comparison of 2011 and 2013 Sediment/Soil Samples

The 2013 post-flood sediment samples had somewhat higher measured Chromium III levels than the 2011 pre-flood sediment samples at sites IC-S1 and IC-S3.

Comparison of Depth-Discrete Sediment/Soil Samples Collected in 2013 at Site IC-S1

The depth-discrete sediment/soil samples had similar measured Chromium III levels.

4.4.1.9 *Metals – Copper*

Constituent: Metals – Copper							
			Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location		Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
IC-S1	(2011)	14.3	-----	4J	-----	-----	< 1
IC-S1A	(2013)	17.5	20	7	3,180	10J	6J
IC-S1B	(2013)	27.5	20	7	1,580	20J	< 4
IC-S3	(2011)	18.3	-----	4J	-----	-----	< 1
IC-S3	(2013)	18.7	20	7	2,720	40	< 4
IC-S5	(2011)	22.4	-----	4J	-----	-----	< 1
MEAN	**(2011)**	**18.3**	**-----**	**-----**	**-----**	**-----**	**< 1**
MEAN	**(2013)**	**21.2**	**-----**	**-----**	**2,493**	**23**	**< 4**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Copper; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard (Secondary)
Copper *Hardness = 264mg/L*	34 µg/L	21 µg/L	1,000 µg/L

Comparison of Copper Elutriate Tests to Water Quality Standards

The filtered elutriate tests (dissolved) for Copper for all the 2011 and 2013 analyses were below the acute and chronic criteria for Aquatic Life Class A. The 2013 non-filtered elutriate tests (total) for Copper were below the Public Drinking Water Standard.

The 2013 pre-elutriate samples for total Copper were elevated. This could represent an "end-of-pipe" concern for total Copper regarding public drinking water. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by the non-filtered and filtered elutriate testing, Copper levels (total and dissolved) are less than the 1,000 µg/L Public Drinking Water standard after settling and filtration. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Indian Cave State Park project site.

Comparison of 2011 and 2013 Sediment/Soil Samples

The 2011 pre-flood and 2013 post-flood sediment samples had similar measured Cooper levels at sites IC-S1 and IC-S3.

Comparison of Depth-Discrete Sediment/Soil Samples Collected in 2013 at Site IC-S1

The deeper sediment/soil sample had higher measured Cooper levels than the shallower sediment/soil sample.

4.4.1.10 Metals – Iron

Constituent: Metals - Iron						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (μg/L)	Dissolved (μg/L)	Total (μg/L)	Non-Filtered Total Analysis (μg/L)	Filtered Dissolved Analysis (μg/L)
IC-S1A (2013)		12,000	30J	4,192,000	5,350	50J
IC-S1B (2013)		12,000	30J	1,921,000	8,540	10J
IC-S3 (2013)		12,000	30J	3,159,000	6,340	10J
MEAN (2013)		**-----**	**-----**	**3,090,667**	**6,743**	**23J**

Note: Iron was not analyzed in 2011.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Iron; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard (Secondary)
Iron	N/A	1,000 μg/L	300 μg/L

Comparison of Iron Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 2013 sediment/soil samples were less than the chronic Warmwater Aquatic Life Class A criterion for Iron. The non-filtered elutriate tests exceeded the 300 μg/L Public Drinking Water secondary standard. However, Nebraska's water quality standards qualify the application of numerical criteria for public drinking water as follows:

> *"If the natural background level of a parameter is greater than the numerical standard, this shall not in and of itself prohibit the use of the surface water. If the natural background level of a parameter is greater than the numerical standard listed below, the background level shall be used in place of the numerical criteria."*

Ambient water quality concentrations for total Iron in the Missouri River exceed the 300 μg/L public drinking water standard – the measured total Iron concentration of the collected receiving water was 12,000 μg/L. The non-filtered total analysis elutriate testing results were less than the total Iron levels measured in the collected Missouri River receiving water.

4.4.1.11 *Metals – Lead*

Constituent: Metals – Lead						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
IC-S1 (2011)	10.3	-----	< 0.5	-----	-----	< 0.5
IC-S1A (2013)	15.0	9	0.6	2,120	3.2	0.6
IC-S1B (2013)	14.6	9	0.6	1,035	5.1	0.2J
IC-S3 (2011)	12.4	-----	< 0.5	-----	-----	< 0.5
IC-S3 (2013)	14.4	9	0.6	1,738	3.1	0.4J
IC-S5 (2011)	16.0	-----	< 0.5	-----	-----	< 0.5
MEAN (2011)	12.9	-----	-----	-----	-----	< 0.5
MEAN (2013)	14.7	-----	-----	1,631	3.8	0.4J

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Lead; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Lead *Hardness = 264 mg/L*	182 µg/L	7.1 µg/L	N/A

Comparison of Lead Elutriate Tests to Water Quality Standards

The filtered elutriate tests (dissolved) for Lead for all the 2011 and 2013 analyses were below the acute and chronic criteria for Aquatic Life Class A.

Comparison of 2011 and 2013 Sediment/Soil Samples

The 2011 pre-flood sediment/soil samples had slightly lower measured Lead levels than the 2013 post-flood sediment/soil at sites IC-S1 and IC-S3.

Comparison of Depth-Discrete Sediment/Soil Samples Collected in 2013 at Site IC-S1

The depth-discrete sediment/soil samples at site IC-S1 had similar measured Lead levels.

4.4.1.12 *Metals – Manganese*

Constituent: Metals - Manganese						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
IC-S1A (2013)		610	< 4	136,400	160	< 4
IC-S1B (2013)		610	< 4	47,740	160	< 4
IC-S3 (2013)		610	< 4	100,700	150	< 4
MEAN (2013)		**-----**	**-----**	**94,933**	**157**	**< 4**

Note: Manganese was not analyzed in 2011.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Manganese; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Manganese	N/A	1,000 µg/L	50 µg/L

Comparison of Manganese Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 2013 sediment/soil samples were less than the chronic Warmwater Aquatic Life Class A criterion for Manganese. The non-filtered elutriate tests exceeded the 50 µg/l public drinking water standard. However, Nebraska's water quality standards qualify the application of numerical criteria for public drinking water as follows:

> *"If the natural background level of a parameter is greater than the numerical standard, this shall not in and of itself prohibit the use of the surface water. If the natural background level of a parameter is greater than the numerical standard listed below, the background level shall be used in place of the numerical criteria."*

Ambient water quality concentrations for total Manganese in the Missouri River exceed the 50 µg/L public drinking water standard – the measured total Manganese concentration of the collected receiving water was 610 µg/L. The non-filtered total analysis elutriate testing results were less than the total Manganese levels measured in the collected Missouri River receiving water.

4.4.1.13 *Metals – Mercury*

Constituent: Metals – Mercury							
			Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location		Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
IC-S1	(2011)	< 0.2	-----	< 0.08	-----	-----	< 0.08
IC-S1A	(2013)	0.02J	<0.008	<0.008	4.3	<0.008	<0.008
IC-S1B	(2013)	0.03J	<0.008	<0.008	2.0	<0.008	<0.008
IC-S3	(2011)	< 0.2	-----	< 0.08	-----	-----	< 0.08
IC-S3	(2013)	0.03J	<0.008	<0.008	3.5	<0.008	<0.008
IC-S5	(2011)	< 0.2	-----	< 0.08	-----	-----	< 0.08
MEAN	**(2011)**	< 0.2	-----	-----	-----	-----	<0.08
MEAN	**(2013)**	00.03	-----	-----	3.27	<0.008	<0.008

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Mercury; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Total Recoverable)	Public Drinking water Standard
Mercury	1.40 µg/L	0.77 µg/L	2 µg/L

Comparison of Mercury Elutriate Tests to Water Quality Standards

The filtered elutriate tests (dissolved) for Mercury for all the 2011 and 2013 analyses were below the acute criterion and the 2013 non-filtered elutriate analyses were below the chronic criterion for Aquatic Life Class A. The 2013 non-filtered elutriate tests (total) for Mercury were below the Public Drinking Water Standard.

The 2013 pre-elutriate samples for total Mercury were elevated. This could represent an "end-of-pipe" concern for total Mercury regarding public drinking water. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by the non-filtered and filtered elutriate testing, Mercury levels (total and dissolved) are less than the 2 µg/L Public Drinking Water standard after settling and filtration. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Indian Cave State Park project site.

Comparison of 2011 and 2013 Sediment/Soil Samples

The 2011 pre-flood and 2013 post-flood sediment samples had similar measured Mercury levels at sites IC-S1 and IC-S3.

Comparison of Depth-Discrete Sediment/Soil Samples Collected in 2013 at Site IC-S1

The depth discrete sediment/soil samples at sites IC-S1A and IC-S1B had similar measured Mercury levels.

4.4.1.14 *Metals – Nickel*

Constituent: Metals – Nickel							
			Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location		Sediment/Soil (mg/kg)	Total (μg/L)	Dissolved (μg/L)	Total (μg/L)	Non-Filtered Total Analysis (μg/L)	Filtered Dissolved Analysis (μg/L)
IC-S1	(2011)	14.1	-----	< 10	-----	-----	< 10
IC-S1A	(2013)	22.6	20	30	4,230	20	10J
IC-S1B	(2013)	23.8	20	30	1,850	20	7J
IC-S3	(2011)	20.1	-----	< 10	-----	-----	< 10
IC-S3	(2013)	23.7	20	30	3,300	30	10J
IC-S5	(2011)	25.1	-----	< 10	-----	-----	< 10
MEAN	**(2011)**	**19.8**	**-----**	**-----**	**-----**	**-----**	**< 10**
MEAN	**(2013)**	**23.4**	**-----**	**-----**	**3,133**	**23**	**9J**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Nickel; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Nickel *Hardness = 264 mg/L*	1,064 μg/L	118 μg/L	610 μg/L

Comparison of Nickel Elutriate Tests to Water Quality Standards

The filtered elutriate tests (dissolved) for Nickel for all the 2011 and 2013 analyses were below the acute and chronic criteria for Aquatic Life Class A. The 2013 non-filtered elutriate tests (total) for Nickel were below the Public Drinking Water Standard.

The 2013 pre-elutriate samples for total Nickel were elevated. This could represent an "end-of-pipe" concern for total Nickel regarding public drinking water. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by the non-filtered and filtered elutriate testing, Nickel levels (total and dissolved) are less than the 610 μg/L Public Drinking Water standard after settling and filtration. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Indian Cave State Park project site.

Comparison of 2011 and 2013 Sediment/Soil Samples

The 2013 post-flood sediment samples had somewhat higher measured Nickel levels than the 2011 pre-flood sediment samples at sites IC-S1 and IC-S3.

Comparison of Depth-Discrete Sediment/Soil Samples Collected in 2013 at Site IC-S1

The depth discrete sediment/soil samples at sites IC-S1A and IC-S1B had similar measured Nickel levels.

4.4.1.15 *Metals – Selenium*

Constituent: Metals - Selenium						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
IC-S1A (2013)		5	3	94	7	6
IC-S1B (2013)		5	3	59	14	13
IC-S3 (2013)		5	3	82	4	6
MEAN (2013)		-----	-----	78	8.3	4.3

Note: Selenium was not analyzed in 2011.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Selenium; Warmwater Aquatic Life Class A, Public Drinking Water and Agricultural Class A

Constituent	Acute Standard (Total Recoverable)	Chronic Standard (Total Recoverable)	Public Drinking Water Standard	Agricultural
Selenium	20 µg/L	5.0 µg/L	50 µg/L	20 µg/L

Comparison of Selenium Elutriate Tests to Water Quality Standards

All non-filtered (total) and filtered (dissolved) elutriate tests of the 2013 analysis for Selenium were below the acute criterion for Aquatic Life Class A, Public Drinking Water, and Agricultural Class A. The non-filtered and filtered elutriate tests were slightly higher than the 5 µg/L chronic standard for Warmwater Aquatic Life Class A. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River.

The 2013 pre-elutriate samples for total Selenium were elevated. This could represent an "end-of-pipe" concern for total Selenium regarding public drinking water and agricultural use. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by the non-filtered and filtered elutriate testing, Beryllium levels (total and dissolved) are less than the 50 µg/L Public Drinking Water standard after settling and filtration. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Indian Cave State Park project site.

4.4.1.16 *Metals – Silver*

Constituent: Metals - Silver						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (μg/L)	Dissolved (μg/L)	Total (μg/L)	Non-Filtered Total Analysis (μg/L)	Filtered Dissolved Analysis (μg/L)
IC-S1A (2013)		< 2	< 4	< 10	< 4	< 4
IC-S1B (2013)		< 2	< 4	< 10	< 4	< 4
IC-S3 (2013)		< 2	< 4	< 10	< 4	< 4
MEAN (2013)		**-----**	**-----**	**< 10**	**< 4**	**< 4**

Note: Silver was not analyzed in 2011.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Silver; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Silver *Hardness = 264 mg/L*	18 μg/L	N/A	100 μg/L

Comparison of Silver Elutriate Tests to Water Quality Standards

The pre-elutriate sample and non-filtered and filtered elutriate tests were all below the Silver acute criterion for Warmwater Aquatic Life Class A and the Public Drinking Water standard.

4.4.1.17 *Metals – Thallium*

Constituent: Metals - Thallium						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
IC-S1A (2013)		0.3	< 0.005	39.8	0.09J	< 0.005
IC-S1B (2013)		0.3	< 0.005	20.9	0.10J	< 0.005
IC-S3 (2013)		0.3	< 0.005	34.3	0.10J	< 0.005
MEAN (2013)		-----	-----	31.7	0.10J	< 0.005

Note: Thallium was not analyzed in 2011.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Thallium; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Thallium	1,400 µg/L	0.47 µg/L	0.24µg/L

Comparison of Thallium Elutriate Tests to Water Quality Standards

The filtered elutriate tests (dissolved) for Thallium for the 2013 analyses were below the acute and chronic criteria for Aquatic Life Class A. The 2013 non-filtered elutriate tests (total) for Thallium were below the Public Drinking Water Standard.

The 2013 pre-elutriate samples for total Thallium were elevated. This could represent an "end-of-pipe" concern for total Thallium regarding public drinking water. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by the non-filtered and filtered elutriate testing, Thallium levels (total and dissolved) are less than the 0.24 µg/L Public Drinking Water standard after settling and filtration. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Indian Cave State Park project site.

4.4.1.18 *Metals – Zinc*

Constituent: Metals – Zinc							
			Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location		Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
IC-S1	(2011)	57.5	-----	< 10	-----	-----	10J
IC-S1A	(2013)	69.9	50	8J	12,770	50	20J
IC-S1B	(2013)	75.9	50	8J	5,810	60	10J
IC-S3	(2011)	64.3	-----	< 10	-----	-----	10J
IC-S3	(2013)	65.9	50	8J	9,580	50	10J
IC-S5	(2011)	80.7	-----	< 10	-----	-----	< 10
MEAN	**(2011)**	**67.5**	-----	-----	-----	-----	**10J**
MEAN	**(2013)**	**70.6**	-----	-----	**9,387**	**53**	**13J**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Zinc; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Zinc *Hardness = 264 mg/L*	267 µg/L	267 µg/L	5,000 µg/L

Comparison of Zinc Elutriate Tests to Water Quality Standards

The filtered elutriate tests (dissolved) for Zinc for all the 2011 and 2013 analyses were below the acute and chronic criteria for Aquatic Life Class A. The 2013 non-filtered elutriate tests (total) for Zinc were below the Public Drinking Water Standard.

The 2013 pre-elutriate samples for total Zinc were elevated. This could represent an "end-of-pipe" concern for total Zinc regarding public drinking water. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by the non-filtered and filtered elutriate testing, Zinc levels (total and dissolved) are less than the 5,000 µg/L Public Drinking Water standard after settling and filtration. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Indian Cave State Park project site.

Comparison of 2011 and 2013 Sediment/Soil Samples

The 2013 post-flood sediment samples had somewhat higher measured Zinc levels than the 2011 pre-flood sediment samples at sites IC-S1 and IC-S3.

Comparison of Depth-Discrete Sediment/Soil Samples Collected in 2013 at Site IC-S1

The depth discrete sediment/soil samples at sites IC-S1A and IC-S1B had similar measured Zinc levels.

4.4.1.19 *Nitrate-Nitrite Nitrogen*

Constituent: Nitrate-Nitrite Nitrogen						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
IC-S1 (2011)	2.8		0.7	-----		1.80
IC-S1A (2013)	2.2		2.1	3.08		2.38
IC-S1B (2013)	2.2		2.1	2.77		2.36
IC-S3 (2011)	1.9		0.7	-----		1.60
IC-S3 (2013)	-----		2.1	4.21		3.60
IC-S5 (2011)	1.1		0.7	-----		1.50
MEAN (2011)	**1.9**		**-----**	**-----**		**1.63**
MEAN (2013)	**2.2**		**-----**	**3.35**		**2.78**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

NEBRASKA WATER QUALITY STANDARDS – Nitrate-Nitrite Nitrogen; Agricultural Class A and Public Drinking Water

Constituent	Acute Standard	Chronic Standard	Agricultural	Public Drinking Water Standard
Nitrate-Nitrite Nitrogen	N/A	N/A	100 mg/L	10 mg/L

Comparison of Nitrate-Nitrite Nitrogen Elutriate Tests to Water Quality Standards

All pre-elutriate samples and filtered elutriate tests were less than the Nebraska Agricultural Class A and Public Drinking Water standard for Nitrate-Nitrite Nitrogen.

4.4.1.20 *Organochlorine Pesticide Scan*

Constituent: Organochlorine Pesticide Scan						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
IC-S1 (2011)	n.d.	n.d.			n.d.	
IC-S1A (2013)	n.d.	n.d.			n.d.	
IC-S1B (2013)	n.d.	n.d.			n.d.	
IC-S3 (2011)	n.d.	n.d.			n.d.	
IC-S3 (2013)	n.d.	n.d.			n.d.	
IC-S5 (2011)	n.d.	n.d.			n.d.	

n.d. = Non-detect.

Detection and Reporting Limits – Organochlorine Pesticide Scan:

20 different pesticides were analyzed with varying detection and reporting levels – see Attachments 5 and 6.

Nebraska Water Quality Standards – Organochlorine Pesticides; Warmwater Aquatic Life Class A and Human Health (Fish Consumption)

Organochlorine Pesticide	Acute Standard (µg/L)	Chronic Standard (µg/L)	Human Health Criterion (µg/L)
Aldrin	3	0.0005	0.0005
BHC	100	0.414	0.414
BHC (Alpha)	-----	0.049	0.049
BHC (Beta)	-----	0.17	0.17
Chlordane	2.4	0.0043	-----
DDT	1.1	0.001	-----
DDD	0.6	0.0031	0.0031
DDE	1,050	0.0022	0.0022
Dieldrin	0.24	0.00054	0.00054
Endosulfan (Alpha)	0.22	0.056	-----
Endosulfan (Beta)	0.22	0.056	-----
Endosulfan sulfate	-----	89	89
Endrin	0.086	0.036	-----
Endrin aldehyde	-----	0.30	0.30
Heptachlor	0.52	0.00079	0.00079
Heptachlor epoxide	0.52	0.00039	0.00039
Lindane	0.95	0.16	-----
Methoxychlor	-----	0.03	40
Toxaphene	0.73	0.002	0.0028

Comparison of Organochlorine Pesticide Scan Elutriate Tests to Water Quality Standards

All elutriate tests of the 2011 and 2013 collected sediment/soil samples were non-detectable for the Organochlorine Pesticides included in the Scan. Some of Nebraska's water quality standards for the scanned PCBs were below the detection limits of the scan.

4.4.1.21 *Polychlorinated Biphenyls (PCBs) Scan*

Constituent: Polychlorinated Biphenyls						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
IC-S1 (2011)	n.d.	n.d.			n.d.	
IC-S1A (2013)	n.d.	n.d.			n.d.	
IC-S1B (2013)	n.d.	n.d.			n.d.	
IC-S3 (2011)	n.d.	n.d.			n.d.	
IC-S3 (2013)	n.d.	n.d.			n.d.	
IC-S5 (2011)	n.d.	n.d.			n.d.	

n.d. = Non-detect.

Detection and Reporting Limits – PCB Scan:

Varies by PCB congener – see Attachments 5 and 6.

Nebraska Water Quality Standards – PCBs; Warmwater Aquatic Life Class A and Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Criterion
Polychlorinated Biphenyls	2.0 µg/L	0.00064 µg/L	0.00064 µg/L

Comparison of PCBs Scan Elutriate Tests to Water Quality Standards

All elutriate tests of the 2011 and 2013 collected sediment/soil samples were non-detectable for the PCBs included in the Scan. Some of Nebraska's water quality standards for the scanned pesticides were below the detection limits of the scan.

4.4.1.22 *pH*

Constituent: pH							
			Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location		Sediment/Soil (S.U.)	Field (S.U.)	Lab (S.U.)	Lab (S.U.)	Non-Filtered Total Analysis (S.U.)	Filtered Dissolved Analysis (S.U.)
IC-S1	(2011)	7.7	8.8	8.3	-----	7.9	
IC-S1A	(2013)	7.6	7.7	8.1	7.6	7.8	
IC-S1B	(2013)	7.7	7.7	8.1	7.7	7.8	
IC-S3	(2011)	7.5	8.8	8.3	-----	7.9	
IC-S3	(2013)	7.5	7.7	8.1	7.4	7.5	
IC-S5	(2011)	7.7	8.8	8.3	-----	7.8	

Detection and Reporting Limits – pH: Sediment/Soil and Water = 0.1 S.U. and 0.2 S.U.

Nebraska Water Quality Standards – pH; Warmwater Aquatic Life Class A

Constituent	Minimum Standard	Maximum Standard
pH	6.5 S.U.	9.0 S.U.

Comparison of pH Elutriate Tests to Water Quality Standards

The pH of all pre-elutriate and elutriate tests of the 2011 and 2013 collected sediment/soil samples were within the minimum and maximum pH criteria.

4.4.2 Analyzed Constituents with No Promulgated State Water Quality Standards

The following constituents were analyzed and have no water quality standards numeric criteria promulgated by the State of Iowa or Nebraska:

- Carbonaceous Biochemical Oxygen Demand, 5-Day ($CBOD_5$)
- Chemical Oxygen Demand (COD)
- Kjeldahl Nitrogen, Total (TKN)
- Percent Solids
- Total Organic Carbon (TOC)
- Total Phosphorus
- Total Suspended Solids
- Turbidity

4.4.2.1 *Carbonaceous Biochemical Oxygen Demand (5-day)*

Constituent: Carbonaceous Biochemical Oxygen Demand (5-Day)						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
IC-S1 (2011)		2J		-----	< 2	
IC-S1A (2013)		2		6	2	
IC-S1B (2013)		2		3	2	
IC-S3 (2011)		2J		-----	< 2	
IC-S3 (2013)		2		3	2	
IC-S5 (2011)		2J		-----	2J	
MEAN (2011)		-----		-----	< 2	
MEAN (2013)		-----		4	2	

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

4.4.2.2 *Chemical Oxygen Demand*

Constituent: Chemical Oxygen Demand						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
IC-S1 (2011)		21		-----	17	
IC-S1A (2013)		14		3,350	13	
IC-S1B (2013)		14		1,600	5	
IC-S3 (2011)		21		-----	18	
IC-S3 (2013)		14		3,420	9	
IC-S5 (2011)		21		-----	20	
MEAN (2011)		-----		-----	**18**	
MEAN (2013)		-----		**2,790**	**9**	

4.4.2.3 *Total Kjeldahl Nitrogen*

Constituent: Total Kjeldahl Nitrogen						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
IC-S1 (2011)	809	0.89		-----	0.95	
IC-S1A (2013)	657	1.02		160	0.69	
IC-S1B (2013)	802	1.02		69	0.83	
IC-S3 (2011)	763	0.89		-----	0.99	
IC-S3 (2013)	1,000	1.02		111	0.69	
IC-S5 (2011)	1,385	0.89		-----	1.23	
MEAN (2011)	**986**	-----		-----	**1.06**	
MEAN (2013)	**948**	-----		**113**	**0.74**	

Comparison of 2011 and 2013 Sediment/Soil Samples

The 2011 pre-flood and 2013 post-flood sediment samples had similar measured Total Kjeldahl Nitrogen levels at sites IC-S1 and IC-S3.

Comparison of Depth-Discrete Sediment/Soil Samples Collected in 2013 at Site IC-S1

The depth discrete sediment/soil samples at sites IC-S1A and IC-S1B had similar measured Total Kjeldahl Nitrogen levels.

4.4.2.4 *Percent Solids*

Constituent: Percent Solids						
Sample Location	Sediment/Soil (%)					
IC-S1A (2013)	79.9					
IC-S1B (2013)	80.7					
IC-S3 (2013)	68.6					
MEAN (2013)	**76.4**					

Note: Percent Solids was not analyzed in 2011.

Comparison of Depth-Discrete Sediment/Soil Samples Collected in 2013 at Site IC-S1

The depth discrete sediment/soil samples at sites IC-S1A and IC-S1B had similar measured Percent Solids levels.

4.4.2.5 *Total Organic Carbon*

Constituent: Total Organic Carbon							
			Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location		Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
IC-S1	(2011)	8,000	6.8		-----	8.3	
IC-S1A	(2013)	8,300	4.0		1,550	5.2	
IC-S1B	(2013)	9,900	4.0		823	7.4	
IC-S3	(2011)	10,500	6.8		-----	7.8	
IC-S3	(2013)	9,700	4.0		1,510	6.1	
IC-S5	(2011)	12,200	6.8		-----	7.4	
MEAN	**(2011)**	**10,233**	-----		-----	**7.8**	
MEAN	**(2013)**	**9,300**	-----		**1,294**	**6.2**	

Comparison of 2011 and 2013 Sediment/Soil Samples

The 2011 pre-flood and 2013 post-flood sediment/soil samples had similar measured Total Organic Carbon levels at sites IC-S1 and IC-S3.

Comparison of Depth-Discrete Sediment/Soil Samples Collected in 2013 at Site IC-S1

The shallower sediment/soil sample at sites IC-S1 had a measured Total Organic Carbon level somewhat less than the deeper sediment/soil sample.

4.4.2.6 *Phosphorus*

Constituent: Phosphorus							
			Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location		Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
IC-S1	(2011)	496	0.24	0.07	-----	0.24	0.05
IC-S1A	(2013)	654	0.55	0.12	95	0.18	0.05
IC-S1B	(2013)	674	0.55	0.12	39	0.23	0.04
IC-S3	(2011)	343	0.24	0.07	-----	0.25	0.06
IC-S3	(2013)	757	0.55	0.12	84	0.26	0.07
IC-S5	(2011)	262	0.24	0.07	-----	0.28	0.28
MEAN	**(2011)**	**367**	-----	-----	-----	**0.26**	**0.13**
MEAN	**(2013)**	**695**	-----	-----	**73**	**0.22**	**0.05**

Comparison of 2011 and 2013 Sediment/Soil Samples

The 2013 post-flood sediment/soil samples had higher measured Phosphorus levels than the 2011 pre-flood sediment/soil samples at sites IC-S1 and IC-S3.

Comparison of Depth-Discrete Sediment/Soil Samples Collected in 2013 at Site IC-S1

The shallower and deeper 2013 sediment/soil samples at site IC-S1 had similar measured Phosphorus levels.

4.4.2.7 *Total Suspended Solids*

Constituent: Total Suspended Solids						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
IC-S1 (2011)		184		-----	119	
IC-S1A (2013)		210		444,000	79	
IC-S1B (2013)		210		147,000	95	
IC-S3 (2011)		184		-----	116	
IC-S3 (2013)		210		166,000	67	
IC-S5 (2011)		184		-----	79	
MEAN (2011)		-----		-----	**105**	
MEAN (2013)		-----		**252,333**	**80**	

4.4.2.8 *Turbidity*

Constituent: Turbidity						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil	Total (NTU)	Dissolved (NTU)	Total (NTU)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
IC-S1 (2011)		60		-----	119	-----
IC-S1A (2013)		282		76,900	71	< 1
IC-S1B (2013)		282		29,600	147	< 1
IC-S3 (2011)		60		-----	206	-----
IC-S3 (2013)		282		54,700	115	< 1
IC-S5 (2011)		60		-----	201	-----
MEAN (2011)		-----		-----	**175**	-----
MEAN (2013)		-----		**53,733**	**111**	**< 1**

5 WATER QUALITY FACTUAL DETERMINATIONS

5.1 Physical Substrate Determinations

Table 5 and Figure 5 described the particle size composition of the material identified for excavation for the construction of SWH at the proposed Indian Cave State Park project site. A mean particle size composition for the material identified for excavation at the proposed project site was calculated from the six collected sediment/soil samples. The sediment/soil to be excavated is believed to be alluvial material.

As part of Bank Stabilization and Navigation Project (BSNP), the Omaha District irregularly samples substrate composition in the navigation channel of the Missouri River. In 2007, particle size

composition of the river bottom was measured in the vicinity of the proposed Indian Cave State Park project at RM530 and RM510. Six and eight sediment borings were taken respectively at RM530 and RM510 across the navigation channel. Table 7 shows the mean particle size composition of the substrate samples collected from the navigation channel upstream and downstream of the proposed Indian Cave State Park project site (RM518) at RM530 and RM510. The substrate particle size composition in the navigation channel of the Missouri River indicates that the finer material has been washed out and transported downstream. This is in line with the management goals of the BSNP to maintain the navigation channel.

Table 7. Mean substrate particle size sampled in the Missouri River navigation channel at RM530 and RM510 during 2007.

Sample Location	% Gravel	% Sand	% Silt/Clay
RM530	2.7	95.3	2.1
RM510	3.8	95.6	0.6

Figure 6 plots the mean particle size composition of the sediment/soil samples collected at the proposed Indian Cave State Park project site and from the navigation channel of the Missouri River at RM530 and RM510. As seen in Figure 6, there are more fines in the sediment identified for excavation at the proposed Indian Cave State Park project site as compared to the bottom substrate of the Missouri River navigation channel. This is not unexpected given that the existing sediment at the project site is finer alluvial material that settled out along the river benches during higher flows. As occurs with sediment delivered from inflowing tributaries, the finer material in the proposed dredging discharge will be transported downstream as part of the suspended solids load, and any heavier material will be incorporated into the Missouri River bed-load.

5.2 Suspended Particulate/Turbidity Determinations

The dredge slurry discharge at the "end-of-pipe" will have a high total suspended solids (TSS) concentration and be quite turbid. Table 8 provides the TSS and turbidity levels measured in the pre-elutriate samples prepared from the three 2013 sediment/soil samples collected at the proposed Indian Cave State Park project site. Some local impacts to existing Missouri River water quality from TSS and turbidity can be expected in the immediate vicinity of the dredging discharge.

Table 8. Total suspended solids and turbidity levels measured in pre-elutriate samples prepared from sediment/soil samples collected at the proposed Indian Cave State Park project site.

Sediment/Soil Sample	Total Suspended Solids (mg/L)	Turbidity (NTU)
IC-S1A	444,000	76,900
IC-S1B	147,000	29,600
IC-S3	166,000	54,700
MEAN	**252,333**	**53,733**

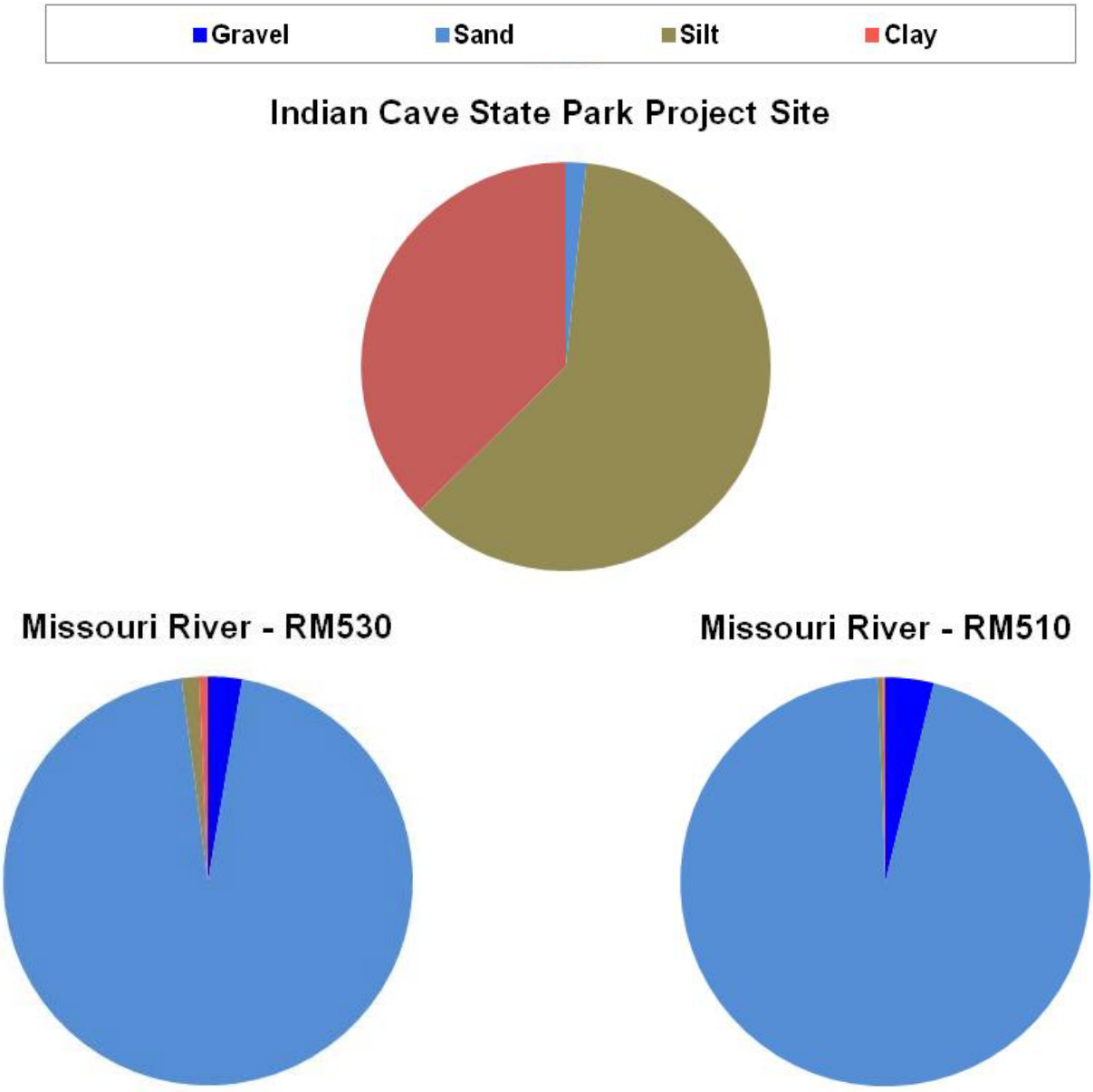

Figure 6. Particle size composition of likely dredge material at the proposed Indian Cave State Park project site and the substrate of the Missouri River bottom in the navigation channel in the area of the proposed project.

Past dredging discharges to construct SWH have attempted to minimize any such impacts by targeted placement of the dredging discharge in the Missouri River (e.g. mid-channel, mid-depth, etc.). The Omaha District assessed in-river TSS and turbidity levels upstream and downstream of the dredging discharge during construction of SWH at the California Bend project site. Four sites were monitored: 1) upstream of the "end-of-pipe", 2) zone of initial dilution at the dredging discharge, 3) 200 feet downstream of the "end-of-pipe" in the discharge plume, and 4) 2,000 feet downstream of the "end-of-pipe in the discharge plume. Table 9 gives TSS and turbidity levels measured at the four locations during dredging discharge in September 2003. Figure 7 plots the same information. As seen in Table 9 and Figure 7, TSS and turbidity levels are elevated in the zone of initial dilution; however, these levels quickly dissipate downstream in the discharge plume.

Table 9. Total suspended solids and turbidity levels monitored in the Missouri River upstream and downstream of the dredging discharge to construct shallow-water habitat at the California Bend project site in 2003.

Date	Upstream of Discharge		Zone of Initial Dilution		200 Feet Downstream		2,000 Feet Downstream	
	TSS (mg/L)	Turbidity (NTUs)	TSS (mg/L)	Turbidity (NTUs)	TSS (mg/L)	Turbidity (NTUs)	TSS (mg/L)	Turbidity (NTUs)
5-Sep-03	46	30	331	218	81	90	29	38
12-Sep-03	84	43	629	414	144	94	74	56

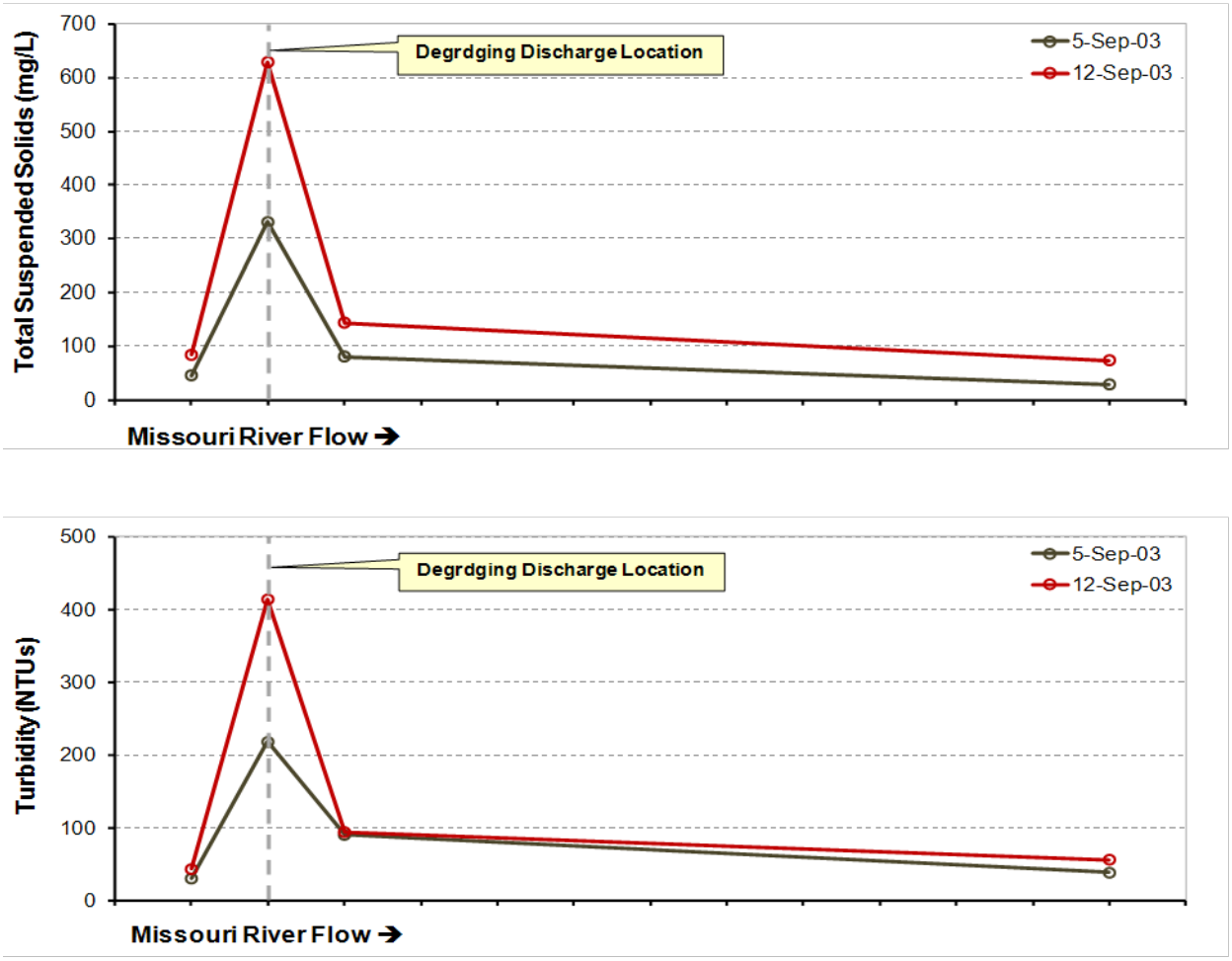

Figure 7. Total suspended solids and turbidity levels monitored in the Missouri River upstream and downstream of the dredging discharge to construct shallow-water habitat at the California Bend project in 2003.

5.3 Contaminant Determinations

5.3.1 Constituents with Promulgated State Water Quality Standards' Criteria

Elutriate testing of representative sediment/soil samples collected at the proposed Indian Cave State Park project included analysis for the following constituents that the State of Nebraska has promulgated water quality standards criteria: Ammonia; Atrazine; Metals: Aluminum, Antimony, Arsenic, Beryllium, Cadmium, Chromium III, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Thallium, Zinc; Nitrate-Nitrite Nitrogen; Organochlorine Pesticides; PCBs; and pH. With the exception of Cadmium and Selenium, none of the prepared elutriate samples exceeded promulgated Nebraska water quality standards criteria. The 2013 filtered elutriate tests for Cadmium (estimated values) were right at the chronic criterion for Warmwater Aquatic Life Class. The 2013 filtered elutriate tests for Selenium were slightly higher than the chronic criterion for Warmwater Aquatic Life Class

The prepared pre-elutriate samples exhibited elevated concentrations, as total, for several metals. This could represent an "end-of-pipe" concern for these metals regarding public drinking water which has metals criteria based on total metals concentrations. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by the non-filtered and filtered elutriate testing, all metals concentrations were below Public Drinking Water standards after settling and filtration. Also, significant dilution of the dredging discharge "end-of-pipe" concentrations will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Indian Cave State Park project site

5.3.2 Nutrients

Table 10 summarizes the nutrient analyses of sediment/soil samples collected at the proposed Indian Cave State Park project site, and pre-elutriate and elutriate samples prepared from the collected sediment/soil samples. Pre-elutriate samples characterize total nutrients (i.e. settlable, suspended, and dissolved) in the prepared 1:4 (sediment to receiving water) mixture. Non-filtered elutriate samples characterize suspended and dissolved nutrients remaining in the mixture supernatant after 1-hour of settling. Filtered elutriate samples characterize dissolved nutrients in the supernatant of the settled mixture. Pre-elutriate samples represent potential "end-of-pipe" nutrient concentrations of the slurry discharge prior to any mixing with the receiving water (i.e. Missouri River). Pre-elutriate samples were analyzed for Total Kjeldahl Nitrogen, Ammonia Nitrogen, Nitrate/Nitrite Nitrogen, and Total Phosphorus. Non-filtered elutriate samples were analyzed for Total Kjeldahl Nitrogen, Total Ammonia Nitrogen, and Total Phosphorus. Standard, filtered elutriate samples were analyzed for dissolved Nitrate-Nitrite Nitrogen and dissolved Phosphorus.

Table 10. Summary of nutrient analyses of sediment/soil samples collected at the proposed Indian Cave State Park shallow-water habitat site in 2011 and 2013 and pre-elutriate and elutriate testing of the collected sediment/soil samples.

	Total Kjeldahl N (mg/L)	Ammonia N (mg/L)	Nitrate-Nitrite N (mg/L)	Phosphorus (mg/L)
Site IC-S1 (2011):				
Sediment/Soil	809*	56.8*	2.8*	496*
Non-Filtered Elutriate	0.95	0.03	-----	0.24
Dissolved Elutriate	-----	-----	1.80	0.05
Site IC-S1A (2013):				
Sediment/Soil	657*	1.9*	2.2*	654*
Pre-Elutriate	160	< 0.1	3.08	95
Non-Filtered Elutriate	0.69	0.07	-----	0.18
Dissolved Elutriate	-----	0.07	2.38	0.05
Site IC-S1B (2013):				
Sediment/Soil	802*	1.4*	2.2*	674*
Pre-Elutriate	69	< 0.1	2.77	39
Non-Filtered Elutriate	0.83	0.08	-----	0.23
Dissolved Elutriate	-----	0.07	2.36	0.04
Site IC-S3 (2011):				
Sediment/Soil	763*	61.0*	1.9*	343*
Non-Filtered Elutriate	0.99	0.08	-----	0.25
Dissolved Elutriate	-----	-----	1.60	0.06
Site IC-S3 (2013):				
Sediment/Soil	1,000*	2.1*	6.2	757*
Pre-Elutriate	111	< 0.1	4.21	84
Non-Filtered Elutriate	0.69	0.05	-----	0.26
Dissolved Elutriate	-----	0.04	3.60	0.07
Site IC-S5 (2011):				
Sediment/Soil	1,385*	108.0*	1.1*	262*
Non-Filtered Elutriate	1.23	0.02	-----	0.28
Dissolved Elutriate	-----	-----	1.50	0.28
Mean Concentration				
Sediment/Soil	**903***	**38.5***	**2.0***	**531***
Pre-Elutriate**	**113**	**<0.1**	**3.35**	**73**
Non-Filtered Elutriate	**0.91**	**0.05**	**-----**	**0.24**
Dissolved Elutriate	**-----**	**0.06****	**2.33**	**0.09**

* mg/kg

** 2013 data only.

5.3.2.1 Estimated Total Tonnage of Nutrients to be Discharged to the Missouri River

It is estimated that that a total of 400,000 cubic yards of material would be excavated and discharged to the Missouri River to construct SWH at the proposed Indian Cave State Park project. Table 5 and Figure 5 describe the particle size composition of the material proposed for excavation. Based on the alluvial material to be excavated, a conversion factor of 85 lbs/ft^3 was used to convert the estimated material volume (400,000 yd^3) to estimated material weight (459,000 tons). The metric tonnage of nutrients that would be discharged to the Missouri River during the period of SWH construction was estimated from the mean nutrient levels determined for the collected sediment/soil samples and the total material to be excavated (Table 11). Currently, the total phosphorus load to the Gulf of Mexico is estimated to be 154,300 metric tons per year, with the contribution of the Missouri River to this total load

estimated to be between 16.8% and 20% (NRC, 2011). If the proposed SWH construction at Indian Cave State Park was completed within one year and the estimated total discharge of 221.11 metric tons of total phosphorus made it to the Gulf of Mexico in one year, it would represent 0.78% of the annual Missouri River total phosphorus load delivered to the Mississippi River, and 0.14% of the annual total phosphorus load delivered to the Gulf of Mexico. These percentages are upper bound estimates, as sediment deposition processes in the Missouri and Mississippi River channels would reduce loads delivered to the Gulf, and actual downstream deliveries would likely be significantly less than these values.

Table 11. Estimated metric tonnage of nutrients that would be discharged to the Missouri River during the entire period shallow-water habitat was constructed at the proposed Indian Cave State Park project.

Total Kjeldahl Nitrogen (metric tons)	Ammonia (metric tons)	Nitrate-Nitrite Nitrogen (metric tons)	Total Phosphorus (metric tons)
376.01	16.03	0.83	221.11

Note: 1 metric ton = 1,000 kg = 2,205 lbs.

5.3.2.2 Potential Impacts to Missouri River Water Quality

5.3.2.2.1 Dredging Discharge Flows

The following information was taken from EM 1110-2-5025 (25-Mar-1983), "*Dredging and Dredged material Disposal*" (USACE, 1983):

> "The hydraulic pipeline cutterhead suction dredge … is equipped with a rotating cutter apparatus surrounding the intake end of the suction pipe, it can effectively dig and pump all types of alluvial materials and compacted deposits, such as clay and hardpan. Slurries of 10 to 20 percent solids (by dry weight) are typical, depending upon the material being dredged, dredging depth, horsepower of dredge pumps, and pumping distance to disposal area. If no other data are available, a pipeline discharge concentration of 13 percent by dry weight (145 ppt) should be used for design purposes. Pipeline discharge velocity, under routine working conditions, ranges from 15-20 ft/sec. Table 12 presents theoretical pipeline discharge rates as functions of pipeline discharge velocity for dredges ranging from 8 to 30 in."

Table 12. Suction dredge pipeline discharge rates (cfs)[(a)] [taken from EM 1110-2-5025].

	Discharge Pipe Diameter			
Discharge Velocity (ft/sec)	**8-inch**	**18-inch**	**24-inch**	**30-inch**
10	3.5	17.7	31.4	49.1
15	5.2	26.5	47.1	73.6
20	7.0	35.3	62.8	98.1
25	8.7	44.2	78.5	122.7

(a) Discharge rate = pipeline area x discharge velocity.
Discharge rate for 20-inch diameter pipe:
Pipe radius = 10 in. = 0.833 ft.
Pipe area = $\pi r^2 = (3.1416)(0.833)^2 = 2.18$ ft^2
Discharge rate = 2.18 ft^2 x 20 ft/sec = 43.6 cfs
Note: Given a velocity of 20 ft/sec was used, this is a maximum estimate for discharge rate.

5.3.2.2.2 Elutriate Testing of Sediment/Soil Samples Collected at the Indian Cave State Park Site

Elutriate testing of the sediment/soil samples collected at the proposed Indian Cave State Park project site was done pursuant to the *"Inland Testing Manual"*. A test slurry was prepared based on a dilution of 1 part sediment to 4 parts receiving water on a volume basis. The 1:4 dilution for elutriate testing represents a 20% slurry. However, elutriate testing is done using "wet" sediment to avoid volatilization of any potential contaminants in the sediment during a drying process. The "wet" sediment was analyzed for percent solids in 2013 and the amount of water present in the sediment sample can be mathematically converted to "dry weight" based on the percent solids quantification. Table 13 estimates the dry-weight percent slurries for each of the elutriate mixtures prepared from the three sediment/soil samples collected at the proposed project site in 2013. The percent slurry estimate is based on the measured percent solids of the collected sediment/soil samples and the 1:4 dilution used to prepare elutriate samples. All of the prepared elutriate mixtures from the collected sediment/soil samples fall within the 10 to 20 percent solids (by dry weight) typical for a hydraulic pipeline cutterhead suction dredge (Table 13).

Table 13. Dry-weight percent slurries represented by the elutriate mixtures prepared from the three sediment/soil samples collected at the proposed Indian Cave State Park shallow-water habitat site in 2013.

Sediment/Soil Sample	Percent Solids	Percent Slurry (Based on Estimated Dry Weight)
IC-S1A	79.9%	16.0%
IC-S1B	80.7%	16.1%
IB-S3	68.4%	13.7%

Note: Based on a 1:4 (dry-weight sediment to water ratio):
- 100% percent solids = 20% slurry
- 50% percent solids = 10% slurry

5.3.2.2.3 Missouri River Nutrient Conditions at Indian Cave State Park Area on 3-May-2011

Tables 14, 15, and 16, respectively, summarize the nutrient concentrations, fluxes, and loadings present in the Missouri River on 3-May-2011 when sediment/soil samples were collected at the proposed Indian Cave State Park project site.

Table 14. Nutrient concentrations measured in the Missouri River at RM518 on 3-May-2011.

Total Kjeldahl N (mg/L)	Ammonia N (mg/L)	Nitrate-Nitrite N (mg/L)	Total P (mg/L)	Dissolved P (mg/L)
0.89	0.31	0.70	0.24	0.07

Table 15. Estimated nutrient fluxes in the Missouri River at RM518 on 3-May-2011 based on measured nutrient concentrations and recorded mean daily flow of 97,200 cfs.

Flow (cfs)	Total Kjeldahl N (kg/sec)	Ammonia N (kg/sec)	Nitrate-Nitrite N (kg/sec)	Total P (kg/sec)	Dissolved P (kg/sec)
97,200	2.4496	0.8532	1.9266	0.6606	0.1927

Table 16. Estimated daily nutrient loadings in the Missouri River at RM518 on 3-May-2011 based on estimated nutrient fluxes.

Flow (cfs)	Total Kjeldahl N (tons/day)	Ammonia N (tons/day)	Nitrate-Nitrite N (tons/day)	Total P (tons/day)	Dissolved P (tons/day)
97,200	233.3	81.3	183.5	62.9	18.4

5.3.2.2.4 Missouri River Nutrient Conditions at Indian Cave State Park Area on 25-Apr-2013

Tables 17, 18, and 19, respectively, summarize the nutrient concentrations, fluxes, and loadings present in the Missouri River on 25-Apr-2013 when sediment/soil samples were collected at the proposed Indian Cave State Park project site.

Table 17. Nutrient concentrations measured in the Missouri River at RM518 on 25-Apr-2013.

Total Kjeldahl N (mg/L)	Ammonia N (mg/L)	Nitrate-Nitrite N (mg/L)	Total P (mg/L)	Dissolved P (mg/L)
1.02	0.14	2.10	0.55	0.12

Table 18. Estimated nutrient fluxes in the Missouri River at RM518 on 25-Apr-2013 based on measured nutrient concentrations and recorded mean daily flow of 33,400 cfs.

Flow (cfs)	Total Kjeldahl N (kg/sec)	Ammonia N (kg/sec)	Nitrate-Nitrite N (kg/sec)	Total P (kg/sec)	Dissolved P (kg/sec)
33,400	0.9647	0.1324	1.9861	0.5202	0.1135

Table 19. Estimated daily nutrient loadings in the Missouri River at RM518 on 25-Apr-2013 based on estimated nutrient fluxes.

Flow (cfs)	Total Kjeldahl N (tons/day)	Ammonia N (tons/day)	Nitrate-Nitrite N (tons/day)	Total P (tons/day)	Dissolved P (tons/day)
33,400	91.9	12.6	189.2	49.5	10.8

5.3.2.2.5 Missouri River Mean Nutrient Conditions at Rulo, Nebraska (RM498)

Mean nutrient conditions were determined for the Missouri River at Rulo, Nebraska (RM498) from monthly water quality sampling of the river by the Omaha District at the site over the 10-year period 2003 through 2012 (Table 20). The Rulo site represents conditions of the Missouri River in the Indian Cave State Park area as it leaves the District.

Table 20. Long-term mean nutrient concentrations measured in the Missouri River at Rulo, NE (RM498) by the Omaha District over the 10-year period 2003 through 2012.

Location	Total Kjeldahl N (mg/L)	Ammonia N (mg/L)	Nitrate-Nitrite N (mg/L)	Total P (mg/L)	Dissolved P (mg/L)
Rulo, NE (RM498)	1.22	0.15	1.68	0.36	0.09

The average mean daily flow of the Missouri River at Rulo, Nebraska was determined from USGS flow records (USGS gauge 06813500). The average mean daily flow of the Missouri River at Rulo (period of record 1967 -2012) was determined to be 46,151 cfs (range = 7,450 - 302,000 cfs; median = 28,500 cfs). The mean daily flow was used to determine nutrient fluxes and loadings based on the Missouri River water quality conditions monitored by the District over the 10-year period 2003 through 2012. Tables 21 and 22, respectively, summarize the long-term mean nutrient fluxes and loadings for the Missouri River at Rulo, Nebraska.

Table 21. Estimated long-term mean nutrient fluxes in the Missouri River at Rulo, NE (RM498) based on 1967-2012 flows and water quality conditions monitored during the 10-year period 2003 through 2012.

Location	Flow (cfs)	Total Kjeldahl N (kg/sec)	Ammonia N (kg/sec)	Nitrate-Nitrite N (kg/sec)	Total P (kg/sec)	Dissolved P (kg/sec)
Rulo, NE (RM498)	46,151	1.5943	0.1960	2.1954	0.4705	0.1176

Table 22. Estimated mean nutrient loadings in the Missouri River at Rulo, NE (RM498) based on estimated long-term mean nutrient fluxes.

Location	Flow (cfs)	Total Kjeldahl N (tons/day)	Ammonia N (tons/day)	Nitrate-Nitrite N (tons/day)	Total P (tons/day)	Dissolved P (tons/day)
Rulo, NE (RM498)	46,151	151.8	18.7	209.1	44.8	11.2

5.3.2.2.6 Estimation of Nutrient Loadings from Potential Hydraulic Dredging Discharge for the Construction of SWH at the Proposed Indian Cave State Park Project Site

5.3.2.2.6.1 Calculated Nutrient Fluxes and Loadings from Potential 20-Inch Hydraulic Dredge Discharge of Excavated Sediment/Soil

Potential nutrient fluxes from hydraulic dredging to excavate SWH at the proposed Indian Cave State Park project site were calculated. The calculated nutrient fluxes were based on use of a typical 20-inch hydraulic dredge (i.e. 43.6 cfs discharge), and mean nutrient levels determined from the six sediment/soil samples collected from the proposed project site. As appropriate, nutrient fluxes for total (pre-elutriate and non-filtered elutriate), and dissolved (filtered elutriate) nutrients were estimated from pre-elutriate and elutriate testing results. Table 23 shows the calculated nutrient fluxes for Total Kjeldahl Nitrogen, Ammonia, Nitrate-Nitrite Nitrogen, Total Phosphorus, and Dissolved Phosphorus. Table 24 shows the estimated daily loadings (tons/day) based on the calculated nutrient fluxes. Table 25 compares the nutrient daily loadings calculated for the 20-inch hydraulic dredge discharge to the long-term average daily loadings for the Missouri River at Rulo, NE.

Table 23. Nutrient flux rates calculated for a typical 20-inch hydraulic dredge discharge (43.6 cfs) based on mean sediment/soil nutrient levels sampled at the proposed Indian Cave State Park project site.

Total Kjeldahl Nitrogen (kg/sec)		Ammonia (kg/sec)		Nitrate-Nitrite Nitrogen (kg/sec)		Phosphorus (kg/sec)		
Pre-Elutriate	Non-Filtered Elutriate	Pre-Elutriate	Non-Filtered Elutriate	Pre-Elutriate	Filtered Elutriate	Pre-Elutriate	Non-Filtered Elutriate	Filtered Elutriate
0.1395	0.0011	0.0001	0.0001	0.0041	0.0029	0.0901	0.0003	0.0001

Table 24. Daily nutrient loadings estimated for a typical 20-inch hydraulic dredge discharge (43.6 cfs) operating 12 hours a day based on nutrient fluxes calculated for mean sediment/soil nutrient levels sampled at the proposed Indian Cave State Park project site.

Total Kjeldahl Nitrogen (tons/day)		Ammonia (tons/day)		Nitrate-Nitrite Nitrogen (tons/day)		Phosphorus (tons/day)		
Pre-Elutriate	Non-Filtered Elutriate	Pre-Elutriate	Non-Filtered Elutriate	Pre-Elutriate	Filtered Elutriate	Pre-Elutriate	Non-Filtered Elutriate	Filtered Elutriate
6.6435	0.0535	0.0059	0.0029	0.1970	0.1370	4.2918	0.0141	0.0053

Table 25. Comparison of daily nutrient loadings for the estimated dredging discharge from the proposed Indian Cave State Park shallow-water habitat construction project and the Missouri River average conditions at Rulo, Nebraska (RM498).

Total Kjeldahl Nitrogen (tons/day)		Ammonia (tons/day)		Nitrate-Nitrite Nitrogen (tons/day)		Phosphorus (tons/day)		
Pre-Elutriate	Non-Filtered Elutriate	Pre-Elutriate	Non-Filtered Elutriate	Pre-Elutriate	Filtered Elutriate	Pre-Elutriate	Non-Filtered Elutriate	Filtered Elutriate
20-inch Hydraulic Dredge Discharge (43.6 cfs)								
6.6435	0.0535	0.0059	0.0029	0.1970	0.1370	4.2918	0.0141	0.0053
Missouri River Long-Term Mean Conditions (Mean Flow = 46,151)								
151.8		18.7		209.1		44.8		11.2
20-in Hydraulic Dredge Discharge Load as a Percent of the Long-term Mean Missouri River Load at RM498								
4.38%	0.04%	0.03%	0.02%	0.09%	< 0.01%	9.58%	< 0.01%	< 0.01%

Note: Dredge flow (43.6 cfs) to mean Missouri River flow (46,151 cfs) is 0.09% (i.e. a dredging discharge of 43.6 cfs would represent 0.09% of the mean Missouri River flow of 46,151 cfs when the dredge was discharging).

5.3.2.2.7 Comparison of Estimated Nutrient Loadings from Hydraulic Dredging at the Proposed Indian Cave State Park Project to Ambient Nutrient Loadings in the Missouri River

The District monitors water quality conditions in the Missouri River from near Landusky, MT (RM1922) to Rulo, NE (RM498). This includes seven locations monitored monthly since 2003 from the Gavins Point Dam tailwaters (RM810) to Rulo, NE. Nutrient constituents monitored monthly include Total Kjeldahl Nitrogen, Ammonia, Nitrate-Nitrite, Total Nitrogen, Total Phosphorus, and Dissolved Phosphorus. Figure 8 displays the mean daily loads calculated for Total Nitrogen, Nitrate-Nitrite Nitrogen, and Total Phosphorus for the seven monitored locations on the Missouri River downstream of Gavins Point Dam over the 5-year period 2007 through 2011. Figure 8 also shows the location of the proposed Indian Cave State Park project site. Figure 9 compares the estimated daily dredging discharge loading for Total Nitrogen, Nitrate-Nitrite Nitrogen, and Total Phosphorus and the calculated mean daily loads for the Missouri River immediately upstream (i.e. RM563) and downstream (i.e. RM498) of the proposed Indian Cave State Park project site. Total nitrogen was determined by adding Total Kjeldahl Nitrogen and Nitrate-Nitrite Nitrogen. As indicated in Table 25 and Figure 9, the estimated daily nutrient loading from the proposed Indian Cave State Park project site is minor compared to the nutrient mean daily loading currently present in the Missouri River. The greatest nutrient loading from the proposed dredging would be for Total Phosphorus where the dredging discharge daily loading could result in a 9.6% increase in the mean daily suspended Total Phosphorus loading currently present in the Missouri River. It is noted that some of the discharged particulate material, and associated phosphorus, would settle to the bottom of the Missouri River when discharged and be incorporated in the river's bed-load. The difference between a pre-elutriate sample and a non-filtered sample for Total Phosphorus is 1-hour of

settling time. The elutriate testing of the collected Indian Cave State Park sediment samples resulted in mean pre-elutriate and non-filtered elutriate Total Phosphorus concentrations of 73 mg/L and 0.24 mg/L, respectively (i.e. 99.7% of the total phosphorus present in the pre-elutriate samples settled out after 1-hour).

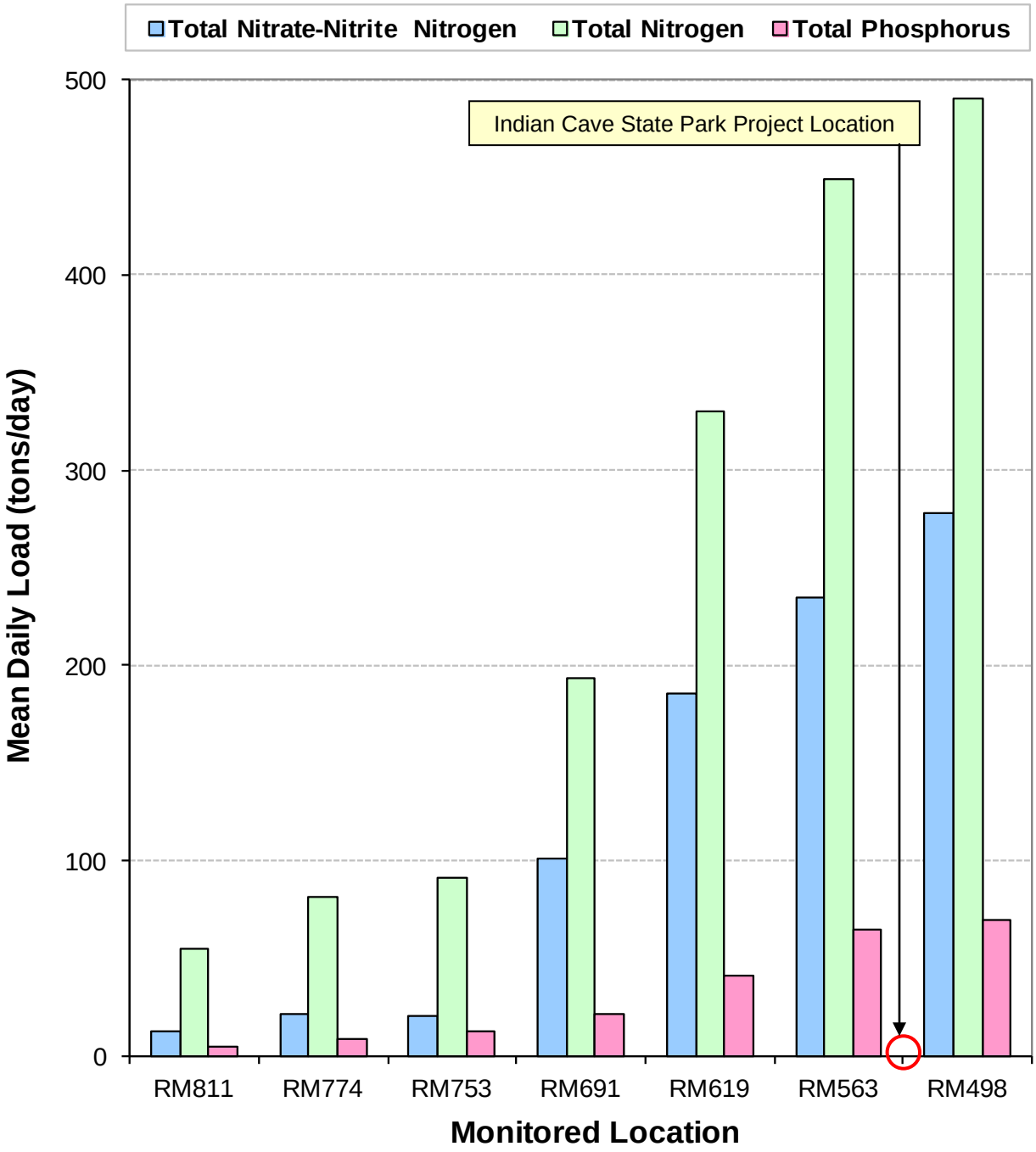

Figure 8. Mean daily loads for Total Nitrogen, Nitrate-Nitrite Nitrogen, and Total Phosphorus based on monthly monitoring along the Missouri River from Gavins Point Dam to Rulo, Nebraska over the 5-year period 2007 through 2011.

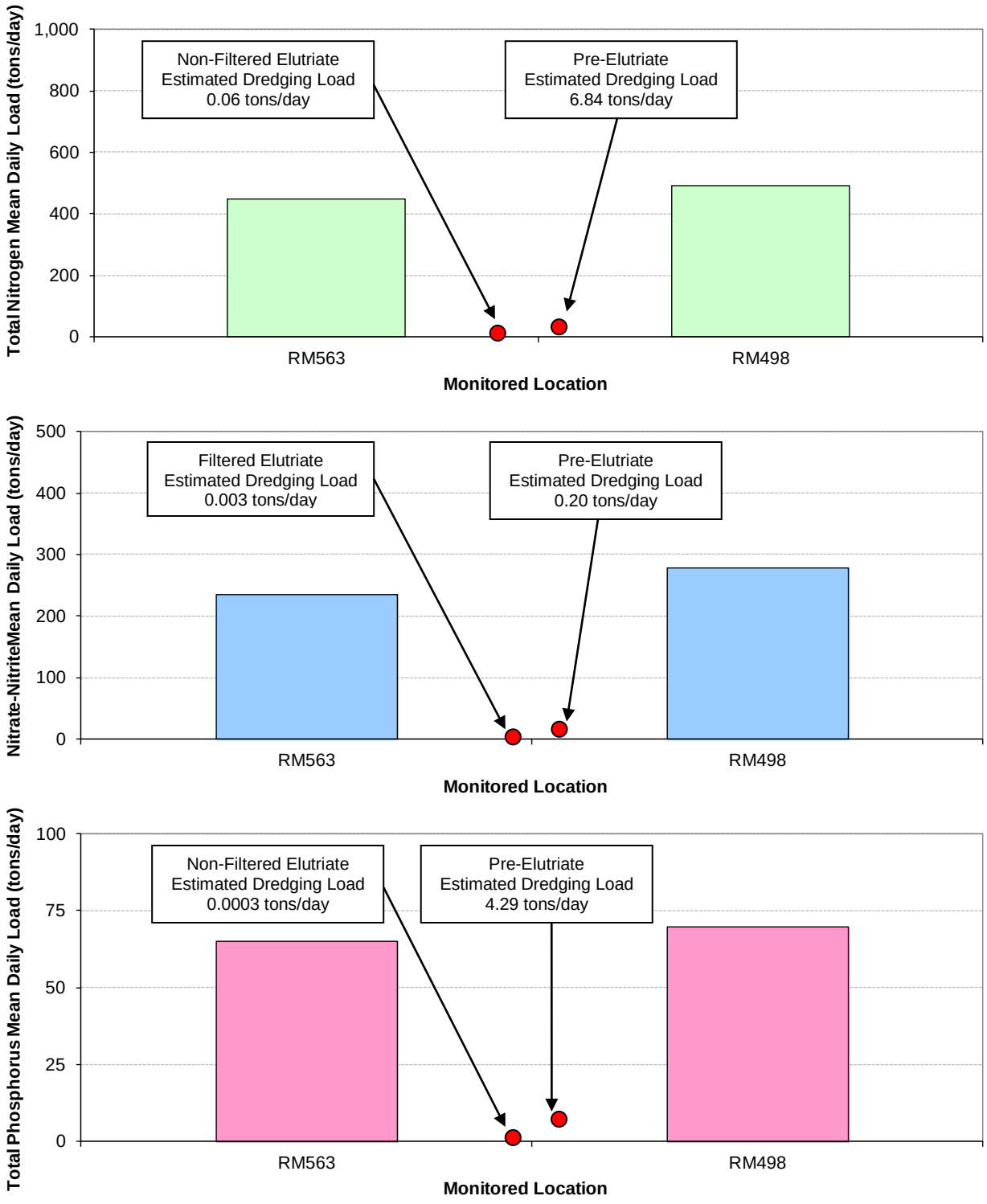

Figure 9. Comparison of estimated Total Nitrogen, Nitrate-Nitrite Nitrogen, and Total Phosphorus daily loadings from hydraulic dredging discharge to construct proposed shallow-water habitat at the Indian Cave State Park project site to mean daily loadings calculated for the Missouri River at RM563 and RM498 over the 5-year period 2007 though 2011.

5.4 Proposed Disposal Site Determinations

Mixing zone provisions for water quality standards application typically apply to "toxic contaminants" released from a point source discharge. State water quality standards, in most cases, define acute and chronic numeric criteria for toxic contaminants. Mixing zones are meant to provide water quality protection to a waterbody receiving a point source discharge, while at the same time allowing the discharge to initially mix and disperse within the receiving waterbody. Generally, mixing zones include both "acute" and "chronic" zones of mixing. Acute mixing zones (exceedance of acute criteria) are more restricted and typically must allow for a zone of passage for aquatic life and are not to extend across public drinking water supply intakes, heavily used recreation areas, mouths of tributary streams, etc. Chronic mixing zones (exceedance of chronic criteria) are less restrictive in that a zone of passage is typically not required, but they also typically are not to extend across public drinking water supply intakes and heavily used recreation.

The Section 404(b)(1) Guidelines, at §230.11(f), allow for mixing zones. Mixing zones for dredge and fill discharges are to be confined to the smallest practicable zone that is consistent with the type of dispersion determined to be appropriate. The following factors are identified in §230.11(f) for consideration in determining the acceptability of a proposed mixing zone:

- Depth of water at the disposal site;
- Current velocity, direction, and variability at the disposal site;
- Degree of turbulence;
- Stratification attributable to causes such as obstructions, salinity or density profiles at the disposal site;
- Rate of discharge;
- Ambient concentration of constituents of interest;
- Dredged material characteristics, particularly concentrations of constituents, amount of material, type of material (sand, silt, clay, etc.) and settling velocities;
- Number of discharge actions per unit of time; and
- Other factors of the disposal site that affect the rates and patterns of mixing.

Elutriate testing of the collected sediment/soil samples at the proposed Indian Cave State Park project site indicated that all assessed constituents, except Cadmium and Selenium, met applicable acute and chronic Nebraska numeric water quality standards criteria. Chronic criteria for Cadmium and Selenium were, respectively, just met or slightly exceeded. Pre-elutriate testing indicated potentially elevated total metals levels that could be problematic regarding Public Drinking Water Supply standards; however, there are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Indian Cave State Park project site. Since a "regulated" mixing is not needed to ensure compliance with acute aquatic life water quality criteria and no drinking water supply intakes are in the immediate vicinity of the proposed dredging discharge, it's assumed complete mixing of the dredging discharge with the flow in the Missouri River is appropriate in evaluating potential impacts to existing water quality pursuant to State and Federal antidegradation provisions. It is assumed antidegradation provisions would apply at the edge of a permitted mixing zone.

5.4.1 Completely Mixed Conditions

Impacts of the proposed dredging discharge on existing water quality in the Missouri River was evaluated after consideration was given for complete mixing of the dredging discharge with the long-term mean flow in the Missouri River. This was accomplished by calculating a flow-weighted average concentration for a water quality constituent based on flow and constituent concentration in the Missouri River and dredging discharge. The average mean daily flow of the Missouri River at Rulo, Nebraska was determined from USGS flow records (USGS gauge 06813500). The average mean daily flow of the Missouri River at Rulo (period of record 1967 -2012) was determined to be 46,151 cfs (range = 7,450 – 302,000 cfs; median = 28,500 cfs).

5.4.2 Existing Missouri River Water Quality

Since 2003, the District has monitored water quality conditions monthly at seven locations along the Missouri River from the Gavins Point Dam tailwaters to Rulo, Nebraska. Constituents monitored monthly include Chemical Oxygen Demand, Total Organic Carbon, Total Kjeldahl Nitrogen, Ammonia, Nitrate-Nitrite, Total Nitrogen, Total Phosphorus, and Dissolved Phosphorus. The elutriate testing results of the sediment/soil collected at the proposed Indian Cave State Park project site were compared (plotted) to the ambient water quality conditions monitored in the Missouri River at Rulo, NE over the 5-year period 2007 through 2011 (Figures 10 - 17). Calculation of completely mixed conditions was applied to the estimated pre-elutriate results for Total Organic Carbon, Total Kjeldahl Nitrogen, and Total Phosphorus; and monitored Missouri River water quality conditions over the 10-year period (2003 - 2012). Table 26 summarizes the calculation of completely mixed conditions for Total Organic Carbon, Total Nitrogen, and Total Phosphorus.

Table 26. Completely mixed, flow-weighted conditions for estimated pre-elutriate concentrations of Total Organic Carbon, Total Kjeldahl Nitrogen and Total Phosphorus.

Water Quality Constituent	Missouri River		Dredging Discharge		Completely Mixed Concentration
	Average Flow (cfs)	Average Concentration	Design Flow (cfs)	Average Pre-Elutriate Concentration	
Carbon, Total Organic (mg/L)	46,151	4.5	43.6	1,294	5.7
Nitrogen, Kjeldahl Total as N (mg/L)	46,151	1.0	43.6	113	1.1
Phosphorus, Total (mg/L)	46,151	0.21	43.6	73	0.28

5.5 Summary of Water Quality Factual Determinations

- Elutriate testing of the collected sediment/soil samples at the proposed Indian Cave State Park project site indicated that all assessed constituents, except Cadmium and Selenium, met applicable acute and chronic Nebraska numeric water quality standards criteria. Chronic criteria for Cadmium and Selenium were, respectively, just met or slightly exceeded. Elutriate testing results were for both dissolved and non-filtered elutriate sample analyses prepared in accordance with the *"Inland Testing Manual"*.
- The proposed dredging discharge should have minor impacts to the existing water quality of the Missouri River, especially after complete mixing is achieved in the river. Based on analyzed water quality constituents, only minor increases in constituent concentrations, within the natural variability of water quality in the Missouri River, are indicated. The minor impacts to water quality would only occur during the short-time dredging occurred to construct SWH at the proposed Indian Cave State Park project site.
- The dredging discharge to construct SWH at the proposed Indian Cave State Park project site would likely cause a slight increase to the nutrient loading currently present in the Missouri River. It is estimated that the mean daily suspended load for Total Kjeldahl Nitrogen could be increased by 4.38%, the mean daily suspended load for Nitrate-Nitrite Nitrogen could be increased by 0.03%, and the mean daily suspended load for Total Phosphorus could be increased by 9.58%. It is noted that the 9.58% increase in the suspended Total Phosphorus loadings is a worst-case estimate. Most of the suspended Total Phosphorus load is bound to particulate matter, some of which will settle and become incorporated into the bed-load of the Missouri River. As indicated by elutriate testing results, the estimated mean suspended Total Phosphorus concentration of 73 mg/L (pre-elutriate) could decrease to 0.24 mg/L (non-filtered elutriate) after 1-hour of settling time (i.e. 99.7% of the total phosphorus present in the pre-elutriate samples settled out after 1-hour).

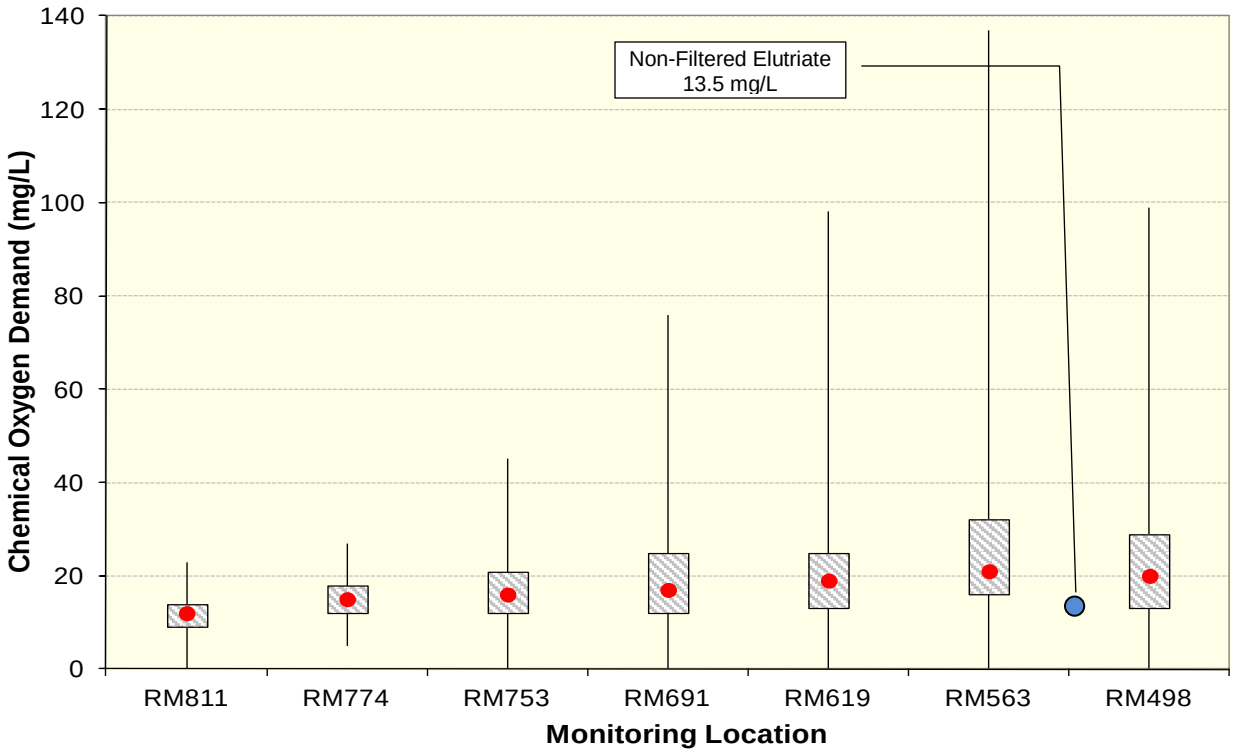

Figure 10. Mean elutriate testing results for Chemical Oxygen Demand as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011. Box plot displays minimum and maximum (whiskers) and inter-quartile range, red dot is the median value.

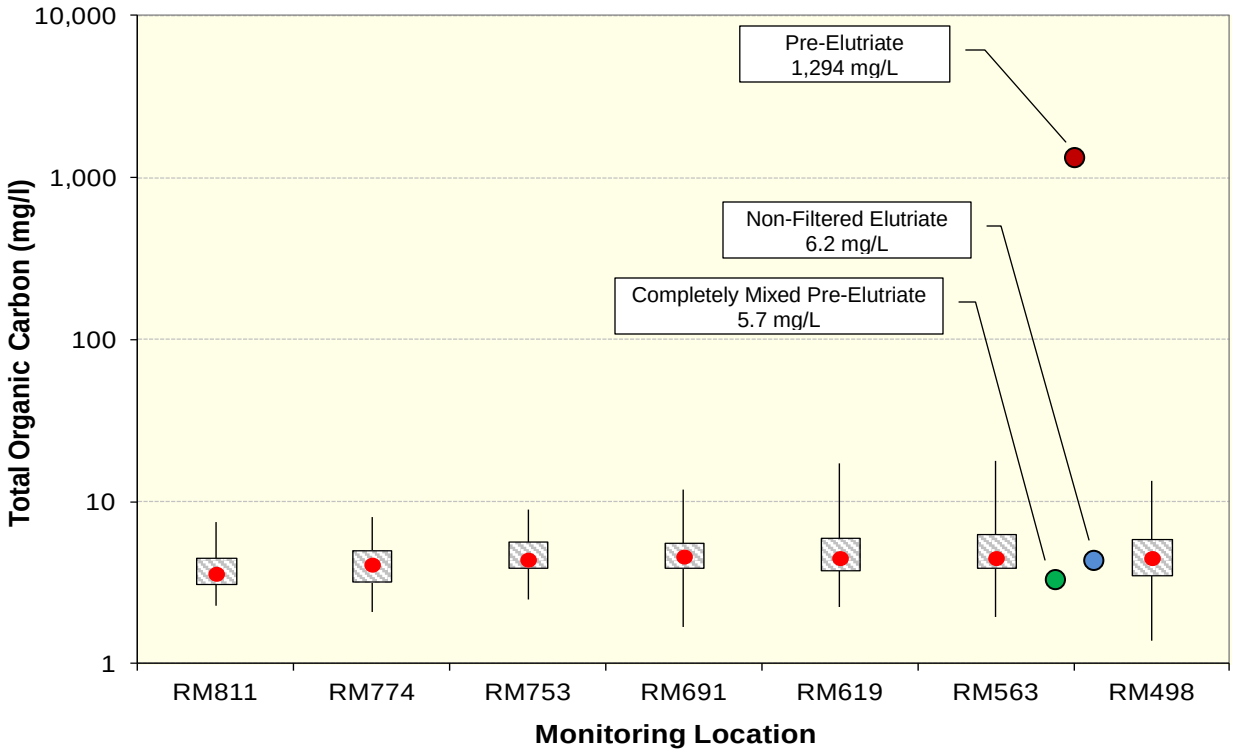

Figure 11. Mean elutriate testing results for Total Organic Carbon as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

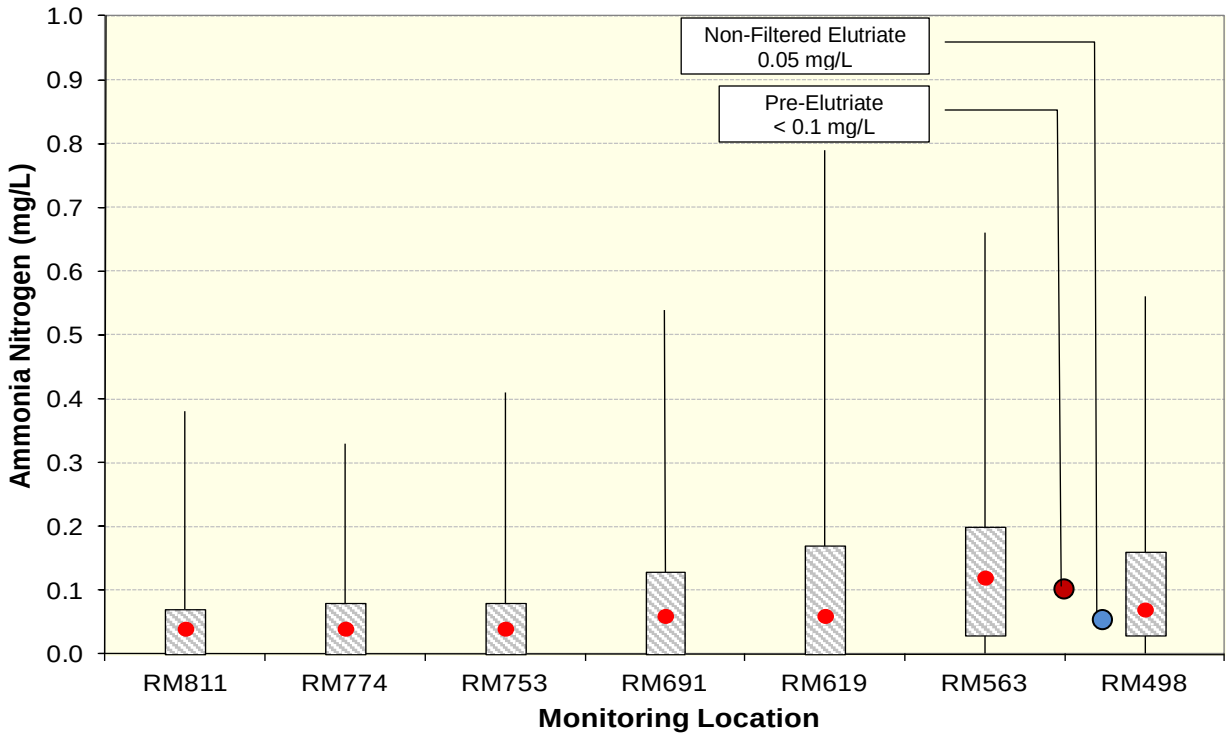

Figure 12. Mean elutriate testing results for Ammonia as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

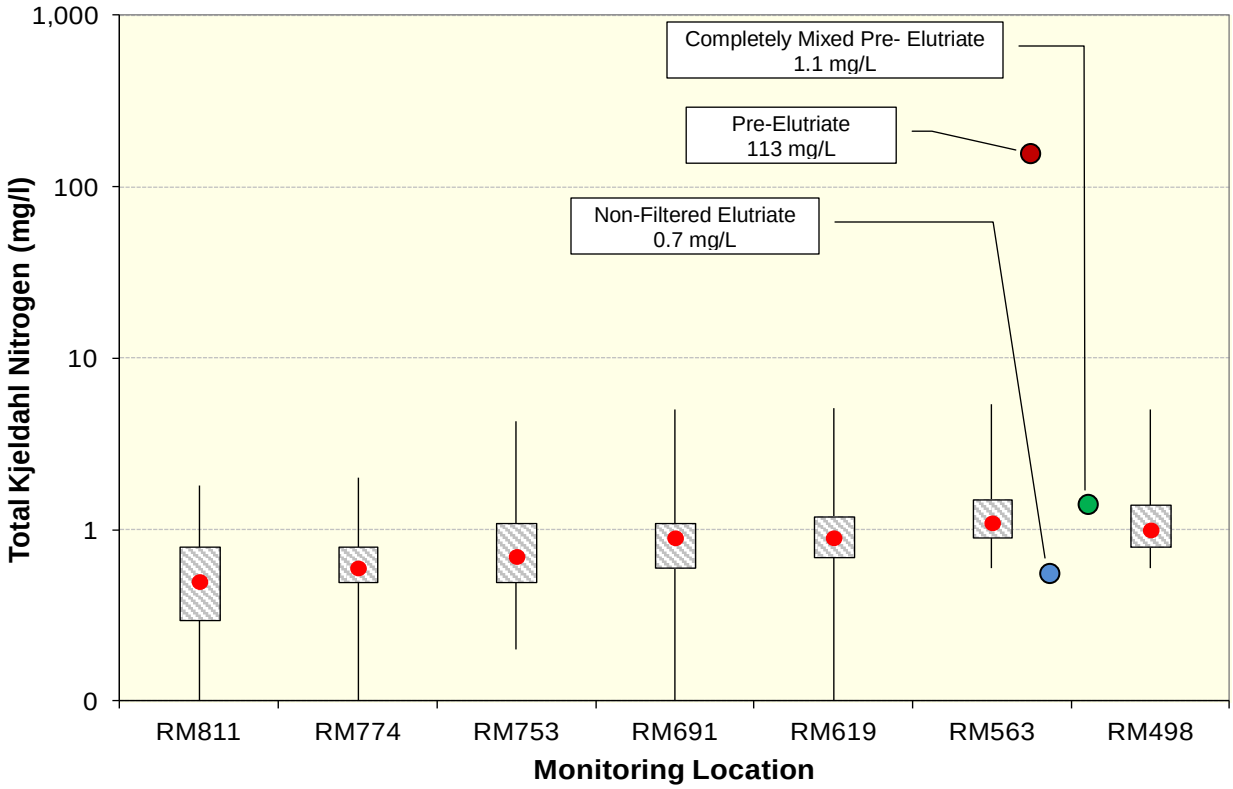

Figure 13. Mean elutriate testing results for Total Kjeldahl Nitrogen as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

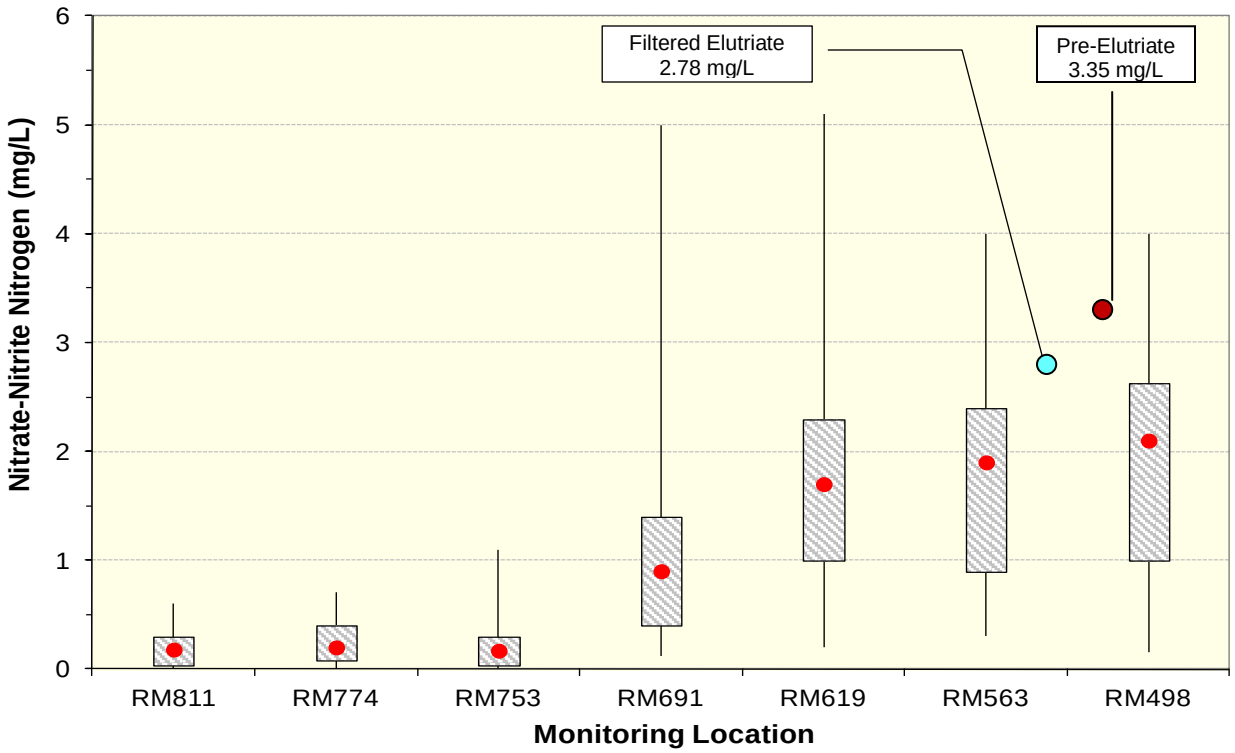

Figure 14. Mean elutriate testing results for Nitrate-Nitrite Nitrogen as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

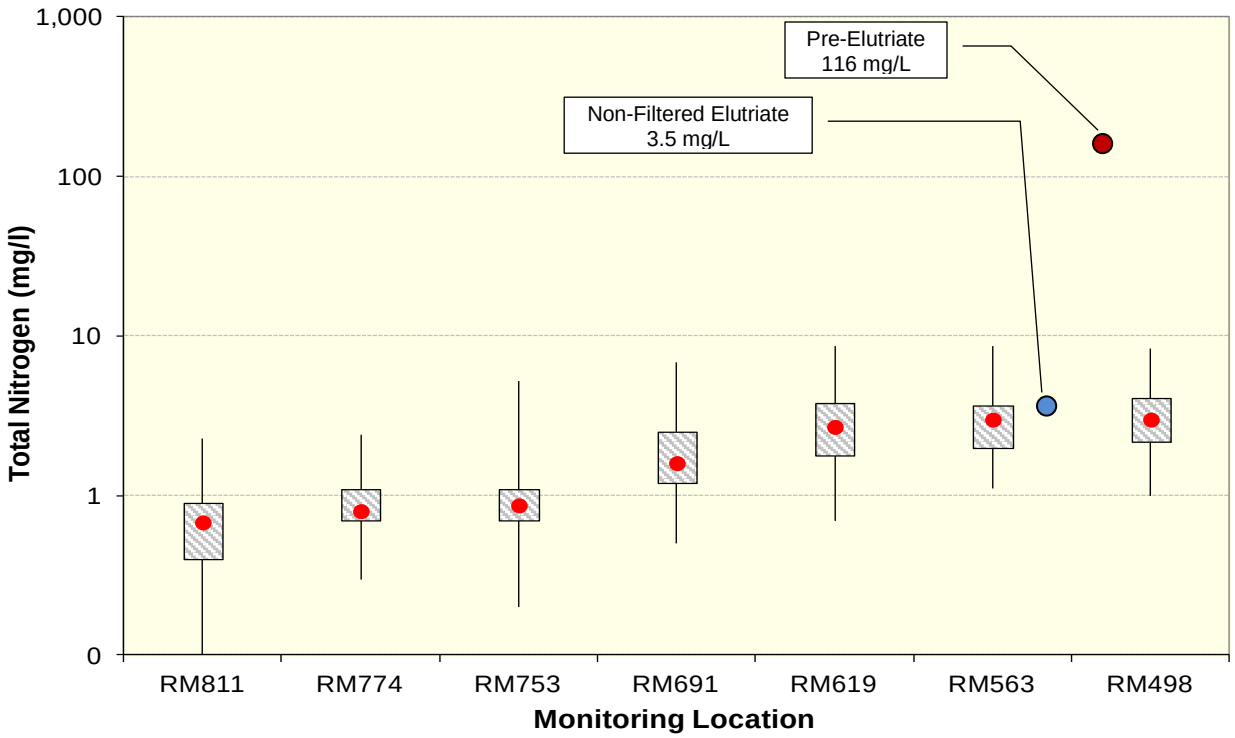

Figure 15. Mean elutriate testing results for Total Nitrogen as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

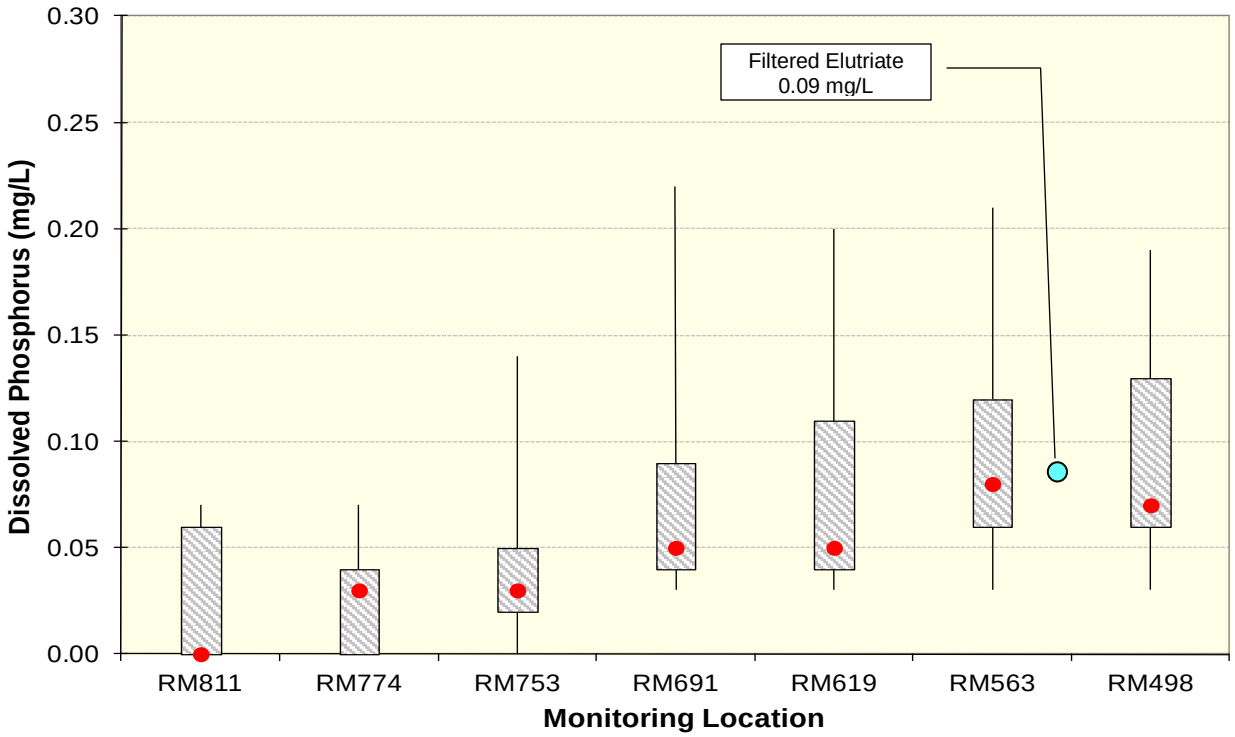

Figure 16. Mean elutriate testing results for Dissolved Phosphorus as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

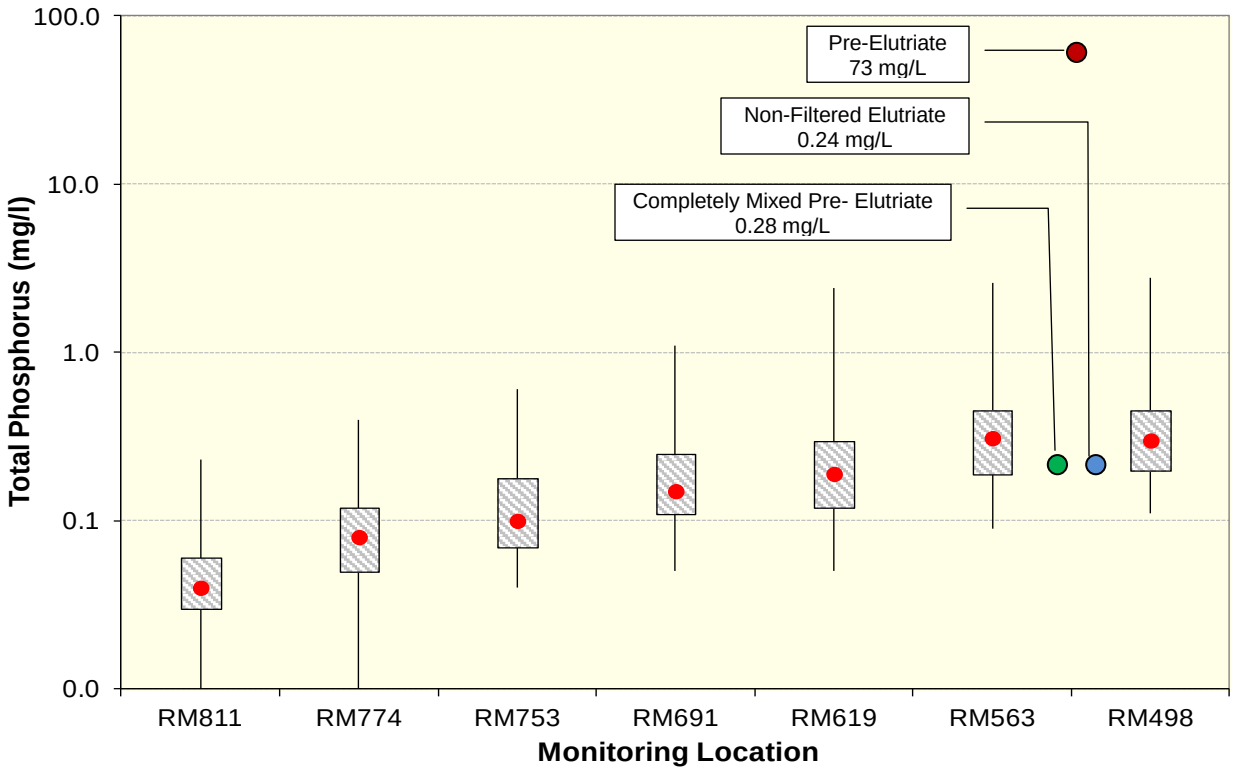

Figure 17. Mean elutriate testing results for Total Phosphorus as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

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ATTACHMENT 1.

Sampling and Analysis Plan for 2011 Elutriate Testing

at the

Proposed Indian Cave State Park Shallow Water Habitat Site

SAMPLING AND ANALYSIS PLAN

for

2011 Elutriate Sampling – Missouri River
Indian Cave Project Area

Project Number: SPS-INCAVE-001

Prepared By:

Water Control and Water Quality Section
Hydrologic Engineering Branch
U.S. Army Corps of Engineers – Omaha District

April 2011

USACE – Water Quality Unit Sampling Coordinator	21-Apr-2011 Date
USACE – Water Quality Unit Team Leader	18-Apr-2011 Date
USACE – Chief, Water Control and Water Quality Section	21-Apr-2011 Date
USACE – Chief, Sedimentation & Channel Stabilization Section	21-Apr-2011 Date
USACE – (CENWO-PM-C)	4-18-11 Date
USACE – (CENWO-PM-AE)	4-21-11 Date

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Luke Wallace

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1. PROJECT DESCRIPTION

1.1. BACKGROUND INFORMATION

A project is being proposed to create shallow-water habitat along the Missouri River in Richardson County, Nebraska. The District is referring to this proposed project as the Indian Cave Project. Soil will be excavated from an old chute area to create shallow-water habitat. Construction of the shallow-water habitat will involve dredging with the dredge spoil being discharged to the Missouri River. It is believed the dredge material will be primarily sand with some silts and clays.

1.1.1. Project Location

The project location is in Indian Cave State Park along the Lower Deroin and Indian Cave Bends of the Missouri River between river miles (RM) 517 and 518 (Attachment 1).

1.1.2. 404 Permitting Requirements

The requirements for a USACE Individual Section 404 permit must be met for the proposed dredging activity. To meet the Section 404 Individual Permit requirements, a Section 401 Certification must be obtained from the State of Nebraska that "certifies" that the proposed actions will not "violate" State water quality standards. To facilitate review of the proposed project for Section 401 Certification, "elutriate sampling" of material from the proposed dredging site will be conducted. This monitoring project plan was developed to collect the appropriate materials for elutriate analysis pursuant to the Inland Testing Manual, "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual (USEPA and USACE, 1998).

2. PROJECT/TASK ORGANIZATION AND RESPONSIBILITIES

The USACE's Water Control and Water Quality Section will conduct the sampling required to facilitate elutriate analysis of prospective dredge material in the project area.

Staff Responsibilities and Contacts for Sampling:
Sample Collection: Dave Jensen (995-2310), Bill Otto (995-2313), John Hargrave (995-2347)
Sampling Coordination: Dave Jensen
Data Quality Review: Dave Jensen
Laboratory Analysis: Midwest Laboratories, Prem Arora (829-9878)

3. SITE-SPECIFIC WATER QUALITY CONCERNS

The State of Nebraska has issued a fish consumption advisory for Dieldrin and PCBs on the Missouri River downstream of Gavins Point Dam. This is based on the analysis of fish tissue samples that found levels of these substances at concentrations above the State's defined risk factor for protecting public health via fish consumption.

Nebraska's water quality standards identify the Missouri River from the Platte River to the Nebraska-Kansas border as designated Segment NE1-10000. Section 303(d) of the Federal Clean Water Act requires States to evaluate water quality conditions in designated waterbodies, and list as impaired (i.e., 303d list) any waterbodies not meeting water quality

standards. As appropriate, States must develop and implement Total Maximum Daily Loads – TMDLs (i.e., pollutant management plans) for waterbodies identified as impaired. Segment NE1-10000 is listed on Nebraska's 2010 Section 303(d) list as impaired due to *E. coli* bacteria and a fish consumption advisory. The identified parameters of concern are *E. coli* and Cancer Risk & Hazard Index Compounds. The Cancer Risk & Hazard Compounds specifically relate to the fish consumption advisory for Dieldrin and PCBs. The State of Nebraska has stated that due to the 303(d) listing of Segment NE1-10000 no dredged material can be discharged into the Missouri River unless concerns regarding *E.* coli, Dieldrin and PCBs are addressed.

This segment of the Missouri River is also designated a recreation use in Nebraska's water quality standards, and as such, *E. coli bacteria levels are not to exceed a geometric mean of 126/100ml based on a minimum of 5 samples taken within a 30-day period.* This criterion applies to the designated recreational period of May 1 through September 30.

Nebraska has promulgated surface water quality criteria for Dieldrin and PCBs of 0.00144 ug/l and 0.0017 ug/l (i.e., 1.4 and 1.7 parts-per-trillion), respectively. These values are defined as human health criteria at the 10^{-5} risk level for carcinogens based on the consumption of fish and other aquatic organisms. If levels of Dieldrin and PCBs determined from elutriate analysis of prospective dredge materials are found to be below the state water quality criteria this should meet potential concerns of the State regarding Dieldrin and PCBs in the discharge of dredged material.

4. DATA QUALITY OBJECTIVES

The data collected through this monitoring project is meant to facilitate the review of the proposed dredging project by the State of Nebraska for Section 401 Water Quality Certification.

5. DATA COLLECTION APPROACH

5.1. DATA COLLECTION DESIGN

5.1.1. Soil and Receiving Water Samples

Soil samples will be collected at five sites (IC-S1, IC-S2, IC-S3, IC-S4, and IC-S5) and receiving water (Missouri River) at one site (IC-W1). The location of the six sites within the project area is shown in Attachment 2. Preliminary latitude and longitude coordinates for the six sites are given below. The "actual" location of the sampled sites will be determined with a GPS unit in the field when the samples are collected.

Site	Latitude	Longitude
IC-S1	40° 15' 06.5"	95° 32' 08.5"
IC-S2	40° 15' 04.7"	95° 32' 02.5"
IC-S3	40° 15' 02.2"	95° 31' 55.1"
IC-S4	40° 14' 59.8"	95° 31' 47.7"
IC-S5	40° 14' 58.6"	95° 31' 41.0"
IC-W1	40° 15' 20.9"	95° 32' 24.4"

5.2. MEASUREMENT AND SAMPLING METHODS

5.2.1. Receiving Water Sample

Water from the dredge site (i.e., receiving water) will be used to prepare elutriate samples (see Section 2.2.3). The laboratory requires 4 gallons of receiving water for each 1 gallon of soil/sediment to be analyzed. In addition to the 4 gallons of water for each 1 gallon soil/sediment, an additional gallon of receiving water is required. The receiving water will be collected at Site IC-W1 near the boat ramp.

At the time the receiving water is collected, the following field measurements will be taken: dissolved oxygen, pH, water temperature, conductivity, and turbidity. These measurements will be obtained with a "HydroLab" equipped with a MS5 DataSonde and Surveyor data logger. Measurements will be taken by immersion of the DataSonde directly into the river. Measurements will be appropriately recorded on a field sheet (Attachment 3).

5.2.2. Soil Samples

Soil samples will be collected at Sites IC-S1, IC-S2, IC-S3, IC-S4, and IC-S5. The equipment, supplies, and procedures to be used to collect the soil samples are as follows.

5.2.2.1. Equipment and Supplies

1) Gas powered auger head
2) Stainless steel coring device
3) Gasoline
4) 1 gallon wide mouth glass jars
5) 1 gallon narrow mouth glass jugs
6) Sample bottle labels
7) ARF
8) Field Sheets
9) GPS device
10) 5 gallon buckets
11) Several gallons of tap water
12) Pick/hammer
13) Tarp/cardboard
14) Screwdriver
15) Scrub brush
16) Cooler with Ice

5.2.2.2. Soil Collection Procedure

1) Select sample site and record general information (including Latitude/Longitude) on the field sheet.
2) Remove any vegetation near the proposed boring side (2-3 foot diameter circle).
3) Set out equipment on a tarp near the sample hole. Using a tarp keeps vegetation and other material out of the sample collection bucket.
4) If the ground is frozen, use a pick-type hammer to remove the top 3-6 inches of frozen soil.
5) Attach the corer to the auger head, bore down and collect sample in approximately one-foot increments.

6) After each coring, detach the device from the gas auger, suspend the corer over the sample collection bucket and deposit the sample into the collection bucket.
7) Heavy clays may require a screwdriver, hammer and/or wooden stake or other tool to remove the sample from the corer.
8) When all cores from one site have been collected in the bucket, homogenize the contents and transfer it to a wide mouth glass jar. Affix the sample label to the jar prior to filling it with the sample.
9) Clean the coring device, tools and sample collection bucket with tap water between sample locations.
10. Deliver the samples and an analytical request form to the laboratory analyzing the samples.

5.2.3. Preparation of Elutriate Samples

Elutriate testing will been done on soil samples collected at Sites IC-S1, IC-S3, and IC-S5. Standard elutriate samples will be prepared in accordance with the "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual: Inland Testing Manual" (USEPA and USACE, 1998). The elutriate sample will be prepared by using water from the dredging site. The sample will be prepared by subsampling approximately 1-liter of the collected soil sample from the well-mixed original sample. The soil material and unfiltered receiving water are then combined in a soil-to-water ratio of 1:4 on a volume basis at room temperature. After the correct ratio is achieved, the mixture is stirred vigorously for 30 minutes with a mechanical stirrer/shaker. After the 30 minute mixing period, the mixture is allowed to settle for at least one hour. The supernatant is then siphoned off without disturbing the settled material. As appropriate, a 0.45-micron filter is then used for dissolved inorganic constituents.

5.2.4. Bacteria Analysis

Bacteria analysis will be done on soil samples collected from all five soil sampling sites. Bacteria will be analyzed by diluting the soil with "sterilized" water to an 8:1 ratio of sterilized water to soil. The hydraulic dredging proposed for the project will generally result in a discharge slurry that is 10% to 20% soil and 80% to 90% Missouri River water. A geomean will be calculated for *E. coli* from the five collected soil samples and compared to the State criterion of 126 colonies/100ml. It is noted that the current land use of the area to be dredged is a State Park. The land has not been recently used for confined animal feeding operations or human waste disposal; however, the area is occasionally used for horseback riding within the State Park. It is unlikely that human pathogenic bacteria are present in the soil at appreciable levels.

5.3. SAMPLE HANDLING, CUSTODY, AND TRANSPORT

The collected samples will be transported by sampling personnel to Midwest Laboratories, Inc. in Omaha, Nebraska for analysis. An Analytical Request Form (ARF) will be completed and submitted with the samples delivered to the laboratory (Attachment 4).

5.4. PARAMETERS TO BE MEASURED

The parameters that will be measured or analyzed for the different types of samples are listed in Table 1.

Table 1. Parameters to be measured and analyzed.

Parameter	Sample Analysis		
	Soil	Receiving Water	Elutriate Water
Field Measurements:			
Water Temperature (°C)		X	
pH (S.U)		X	
Dissolved Oxygen (mg/l)		X	
Conductivity (umhos/cm)		X	
Turbidity (NTU)		X	
Laboratory Analysis:			
Atrazine (ug/l)	X	X	X*
Carbonaceous Biochemical Oxygen Demand - CBOD (mg/l)		X	X*
Chemical Oxygen Demand - COD (mg/l)		X	X
Dieldrin (pptrillion)		X	X*
E. coli Bacteria (MPN/100ml)	X		
Nitrogen, Ammonia as N, Total (mg/l)	X	X	X*
Nitrogen, Total Kjeldahl as N (mg/l)	X	X	X*
Nitrogen, Nitrate/Nitrite as N (mg/l)	X	X	X
Organic Carbon, Total - TOC (mg/l)	X	X	X*
Particle Size	X		
PCBs - Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (ug/l)		X	X*
pH (S.U.)			
Phosphorus, Dissolved (mg/l)		X	X
Phosphorus, Total (mg/l)	X	X	X*
Phosphorus, Orthophosphate (mg/l)		X	X
Metals - Dissolved (ug/l) (Aresenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc)		X	X
Metals - Total (mg/kg) (Aresenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc)	X		
Organochlorine Pesticide and PCB Scan (ug/kg)	X		
Organochlorine Pesticide and PCB Scan (ug/l)		X	X*
Total Suspended Solids (mg/l)			
Turbidity (NTU)			
PCBs - Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (pptrillion)		X	X*

***** Determined on supernatant prior to filtration.

5.5. LABORATORY ANALYTICAL METHODS AND COSTS

Table 2 provides methods, detection limits, and costs for parameters to be analyzed on collected soil samples. Table 4 provides methods and detection limits for parameters to be analyzed on filtered elutriate samples. Table 5 provides methods and detection limits for parameters to be analyzed on supernatant elutriate samples. Table 7 provides methods and detection limits for parameters to be analyzed on receiving water.

Table. 2. Parameters to be Analyzed on Collected Soil Samples and Unit Costs.

Parameter	Method	Detection Limit	Analytical Cost
PHYSICAL AND AGGREGATE PROPERTIES			
Particle Size	Sieve (Minimum Sieve #200)	0.001 mm	$60.50
pH	EPA 150.1	0.1 S.U.*	7.15
NUTRIENTS			
Nitrogen, Ammonia Total as N	EPA 350.1	0.02 mg/kg	17.00
Nitrogen, Kjeldahl Total as N	EPA 351.3	0.2 mg/kg	19.75
Nitrogen, Nitrate/Nitrite Total as N	EPA 353.2	0.02 mg/kg	12.75
Phosphorus, Total	SM4500PF	0.02 mg/kg	18.00
AGGREGATE ORGANIC CONSTITUENTS			
Total Organic Carbon	EPA 415.1	0.4 mg/kg	22.00
METALS			
Arsenic, Total	EPA 6010B	10 mg/kg	12.25
Cadmium, Total	EPA 6010B	0.2 mg/kg	12.25
Chromium, Total	EPA 6010B	1 mg/kg	12.25
Copper, Total	EPA 6010B	1 mg/kg	12.25
Lead, Total	EPA 6010B	13 mg/kg	12.25
Mercury, Total	EPA 6010B	0.1 mg/kg	39.50
Nickel, Total	EPA 6010B	1 mg/kg	12.25
Zinc Total	EPA 6010B	2 mg/kg	12.25
PESTICIDES AND PCBs			
Atrazine, Total	EPA 507	0.05 mg/kg	153.00
Organochlorine Pesticide and PCB Scan	EPA 8081 and EPA 8082	See Table 3	180.00
BACTERIA			
E. coli	SM 9222D	1 MPN/100ml	25.00
		Total Laboratory Cost for Analyzing a Soil Sample	**$640.40**

* Resolution limit.

Table 3. Detection and Reporting Limits for individual parameters included in the Organochlorine Pesticide and PCB Scan of sediment samples.

Parameter	Detection Limit (µg/kg)	Reporting Limit (µg/kg)	Parameter	Detection Limit (µg/kg)	Reporting Limit (µg/kg)
DDE	0.8	9.9	Alpha-BHC (alpha-Lindane)	0.4	5.1
DDD	0.7	9.9	Beta-BHC (beta-Lindane)	1.0	5.1
DDT	1.0	9.9	Delta-BHC (delta-Lindane)	1.8	5.1
Methoxychlor	1.2	5.1	Gamma-BHC (gamma-Lindane)	0.6	5.1
Aldrin	0.7	5.1	Gamma-Chlordane	0.8	5.1
Dieldrin	0.7	9.9	PCB - Aroclor1016	10	50
Endosulfan 1	0.7	5.1	PCB - Aroclor1260	10	50
Endosulfan 2	0.8	9.9	PCB - Aroclor1221	10	50
Endosulfan Sulfate	1.0	9.9	PCB - Aroclor1248	10	50
Endrin	1.0	9.9	PCB - Aroclor1268	10	50
Endrin Aldehyde	1.0	9.9	PCB - Aroclor1232	10	50
Endrin Ketone	0.8	9.9	PCB - Aroclor1254	10	50
Heptachlor	0.6	5.1	PCB - Aroclor1242	10	50
Heptachlor Epoxide	0.8	5.1	PCB - Aroclor1262	10	50
Alpha-Chlordane	0.8	5.1			

Table. 4. Parameters to be Analyzed in Filtered Elutriate Water Samples and Unit Costs.

Parameter	Method	Detection Limit	Analytical Cost
SAMPLE PREPARATION			
Elutriate Sample Preparation	1:4 Sediment:Receiving Water	-----	$171.50
PHYSICAL AND AGGREGATE PROPERTIES			
pH	EPA 150.1	0.1 S.U.*	7.15
NUTRIENTS			
Nitrogen, Nitrate/Nitrite as N (mg/l)	EPA 353.2	0.02 mg/l	12.75
Phosphorus, Dissolved	SM4500PF	0.02 mg/l	18.00
Ortho-Phosphorus, Dissolved	EPA 365.1	0.02 mg/l	13.75
AGGREGATE ORGANIC CONSTITUENTS			
Chemical Oxygen Demand	ASTM D1252	3 mg/l	17.50
METALS			
Arsenic, Dissolved	EPA 6010B	1 ug/l	12.25
Cadmium, Dissolved	EPA 6010B	0.2 ug/l	12.25
Chromium, Dissolved	EPA 6010B	10 ug/l	12.25
Copper, Dissolved	EPA 6010B	2 ug/l	12.25
Lead, Dissolved	EPA 6010B	0.5 ug/l	12.25
Mercury, Dissolved	EPA 6010B	0.05 ug/l	39.50
Nickel, Dissolved	EPA 6010B	10 ug/l	12.25
Zinc Dissolved	EPA 6010B	10 ug/l	12.25
Total Laboratory Cost for Analyzing a Standard Elutriate Water Sample			**$369.90**

* Resolution limit.

Table. 5. Parameters to be Analyzed in Supernatant Elutriate Water Samples and Unit Costs.

Parameter*	Method	Detection Limit	Analytical Cost
PHYSICAL AND AGGREGATE PROPERTIES			
Total Suspended Solids	EPA 160.1	5 mg/l	$10.50
Turbidity	EPA 180.1	1 NTU	13.00
NUTRIENTS			
Nitrogen, Ammonia as N, Total	EPA 350.1	0.02 mg/l	17.00
Nitrogen, Total Kjeldahl as N	EPA 351.3	0.2 mg/l	19.75
Phosphorus, Total	SM4500PF	0.02 mg/l	18.00
AGGREGATE ORGANIC CONSTITUENTS			
Carbon, Organic Total	EPA 415.1	0.4 mg/l	25.50
Carbonaceous Biochemical Oxygen Demand - CBOD	SM 5210.B	1 mg/l	28.00
Atrazine (ug/l)	EPA 507	0.05 ug/l	153.00
Dieldrin (ug/l)	EPA - 8081	0.001	612.00
PCBs - Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (ug/l)	EPA - 8082	0.001	612.00
Organochlorine Pesticide and PCB Scan (ug/l)	EPA 8081 EPA 8082	See Table 6	180.00
Total Laboratory Cost for Analyzing a Pre-Elutriate Water Sample			**$1,688.75**

Table 6. Detection and Reporting Limits for individual parameters included in the Organochlorine Pesticide and PCB Scan of water samples.

Parameter	Detection Limit (µg/l)	Reporting Limit (µg/l)	Parameter	Detection Limit (µg/l)	Reporting Limit (µg/l)
DDE	0.005	0.1	Alpha-BHC (alpha-Lindane)	0.009	0.05
DDD	0.005	0.1	Beta-BHC (beta-Lindane)	0.009	0.05
DDT	0.004	0.1	Delta-BHC (delta-Lindane)	0.014	0.05
Methoxychlor	0.005	0.5	Gamma-BHC (gamma-Lindane)	0.035	0.05
Aldrin	0.008	0.5	Gamma-Chlordane	0.006	0.05
Dieldrin	0.004	0.1	PCB - Aroclor1016	0.2	1.0
Endosulfan 1	0.006	0.05	PCB - Aroclor1260	0.2	1.0
Endosulfan 2	0.003	0.1	PCB - Aroclor1221	0.2	2.0
Endosulfan Sulfate	0.010	0.1	PCB - Aroclor1248	0.3	1.0
Endrin	0.003	0.1	PCB - Aroclor1268	0.3	1.0
Endrin Aldehyde	0.011	0.1	PCB - Aroclor1232	0.2	1.0
Endrin Ketone	0.006	0.1	PCB - Aroclor1254	0.2	1.0
Heptachlor	0.009	0.05	PCB - Aroclor1242	0.2	1.0
Heptachlor Epoxide	0.007	0.05	PCB - Aroclor1262	0.2	1.0
Alpha-Chlordane	0.011	0.05			

Table. 7. Parameters to be Analyzed in Receiving Water Sample and Unit Costs.

Parameter	Method	Detection Limit	Analytical Cost
PHYSICAL AND AGGREGATE PROPERTIES			
Total Suspended Solids	EPA 160.2	4 mg/l	10.50
NUTRIENTS			
Nitrogen, Ammonia as N, Total (mg/l)	EPA 350.1	0.02 mg/l	17.00
Nitrogen, Total Kjeldahl as N (mg/l)	EPA 351.3	0.2 mg/l	19.75
Nitrogen, Nitrate/Nitrite as N (mg/l)	EPA 353.2	0.02 mg/l	12.75
Phosphorus, Dissolved	SM4500PF	0.02 mg/l	18.00
Phosphorus, Total	SM4500PF	0.02 mg/l	18.00
Ortho-Phosphorus, Dissolved	EPA 365.1	0.02 mg/l	13.75
AGGREGATE ORGANIC CONSTITUENTS			
Carbonaceous Biochemical Oxygen Demand - CBOD (mg/l)	SM 5210.B	1 mg/l	28.00
Chemical Oxygen Demand	ASTM D1252	3 mg/l	17.50
Organic Carbon, Total	EPA 415.1	0.4 mg/l	25.50
METALS			
Arsenic, Dissolved	EPA 6010B	1 ug/l	12.25
Cadmium, Dissolved	EPA 6010B	0.2 ug/l	12.25
Chromium, Dissolved	EPA 6010B	10 ug/l	12.25
Copper, Dissolved	EPA 6010B	2 ug/l	12.25
Lead, Dissolved	EPA 6010B	0.5 ug/l	12.25
Mercury, Dissolved	EPA 6010B	0.05 ug/l	39.50
Nickel, Dissolved	EPA 6010B	10 ug/l	12.25
Zinc Dissolved	EPA 6010B	10 ug/l	12.25
PESTICIDES AND PCBs			
Organochlorine Pesticide and PCB Scan	EPA 8081 EPA 8082	See Table 6	180.00
Dieldrin (ug/l)	EPA - 8081	0.001	612.00
PCBs - Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (ug/l)	EPA - 8082	0.001	612.00
Total Laboratory Cost for Analyzing the Receiving Water Sample			**$1,710.00**

5.6. QUALITY CONTROL

Where applicable, field measurements and samples will be collected in accordance with SOPs developed by the USACE's Water Control and Water Quality Section.

Laboratory quality control samples and data quality indicators will be utilized in accordance with the Contract Laboratory Quality Assurance Manual. Routine internal quality control checks are placed in the measurement system to assess the quality of the data generated. These checks typically include: with each preparative batch, a Method Blank, a Matrix Spike and Matrix Spike Duplicate, a Laboratory Duplicate, and a Laboratory Control Sample. Inclusion of the Matrix Spike, Matrix Spike Duplicate and Laboratory Duplicate are contingent on sufficient sample material being provided. In addition to the checks within the preparative batch there are analysis batch checks that are also completed (retained on file by

the laboratory, but typically not reported in a standard data package) including Calibration Blanks, Initial Calibration Verifications, and Continuing Calibration Verifications. Additional samples are analyzed periodically (results retained on file) and may include reagent blanks, second source check standards and other performance checks. External quality control checks are provided in the form of Performance and System Audits and Surveillance. A laboratory Quality Assurance Report will be submitted to the District's Water Quality Unit on an appropriate basis.

6. DATA MANAGEMENT AND REPORTING

All water quality measurements and analyses will be verified, validated, and compiled into an excel spreadsheet. Once compiled, the results will be emailed to Laura Bentley (CENWO-PM-C) and Luke Wallace (CENWO-PM-AE).

7. PROJECTED COSTS FOR FIELD COLLECTION AND LABORATORY ANALYSIS OF ELUTRIATE SAMPLES

Field Collection:

Preparation and collection of required samples 20 man hours @ $100 = $,2,000

Laboratory Analysis (Midwest Laboratories):

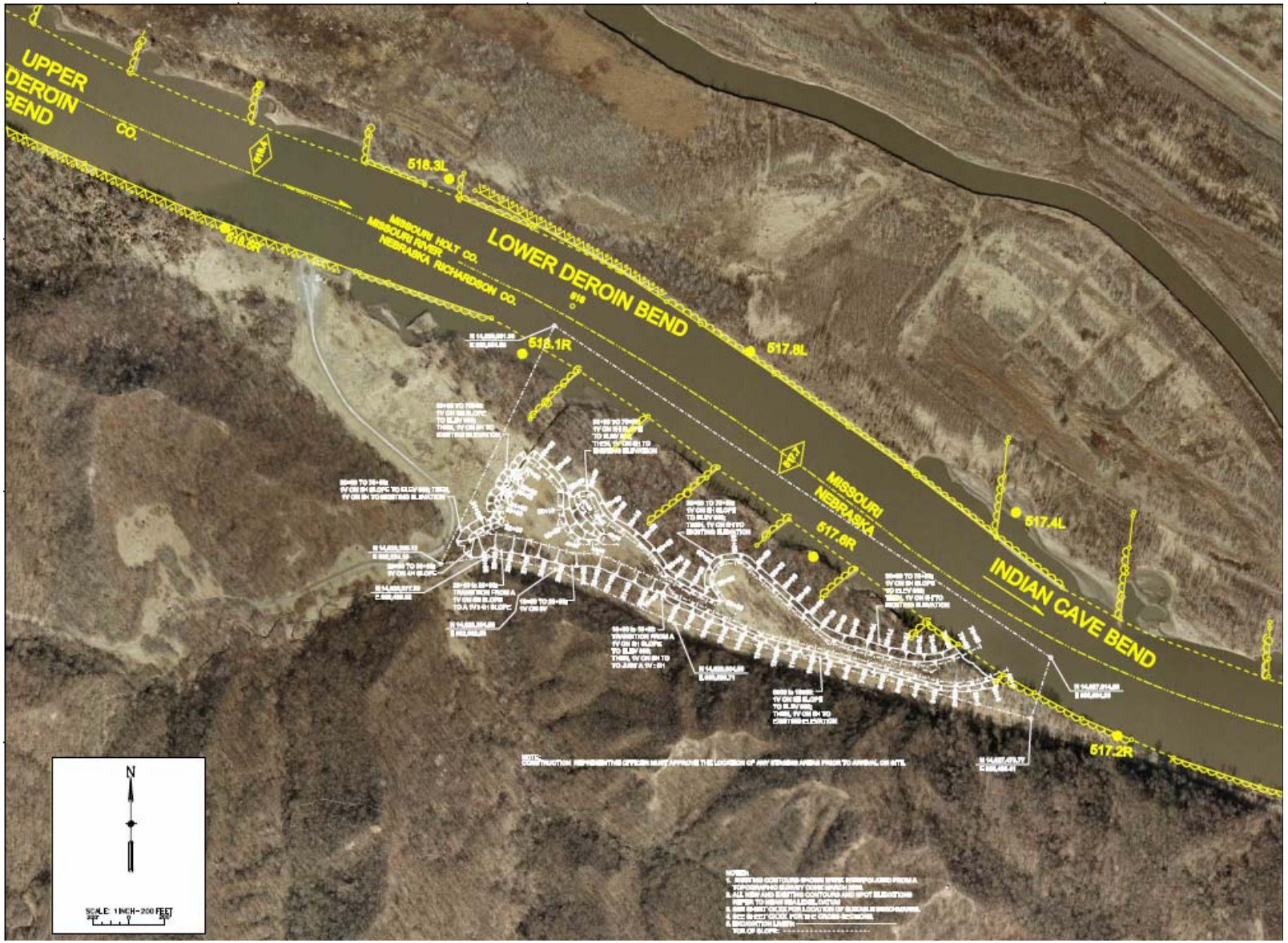
Analyzed Media	Number of Samples	Unit Cost per Sample	Total Cost
Soil	3	$640.40	$1,921.20
Soil – *E. coli* Bacteria Only	2	$11.75	$23.50
Elutriate - Filtered	3	$369.90	$1,109.75
Elutriate Supernatant	3	$1,688.75	$5,066.25
Receiving Water	1	$1,710.00	$1,710.00
TOTAL ANALYSTICAL COSTS			**$9,830.70**

Total Costs = $2,000.00 (Field Collection) + $9,830.70 (Lab Analysis) = $11,830.70

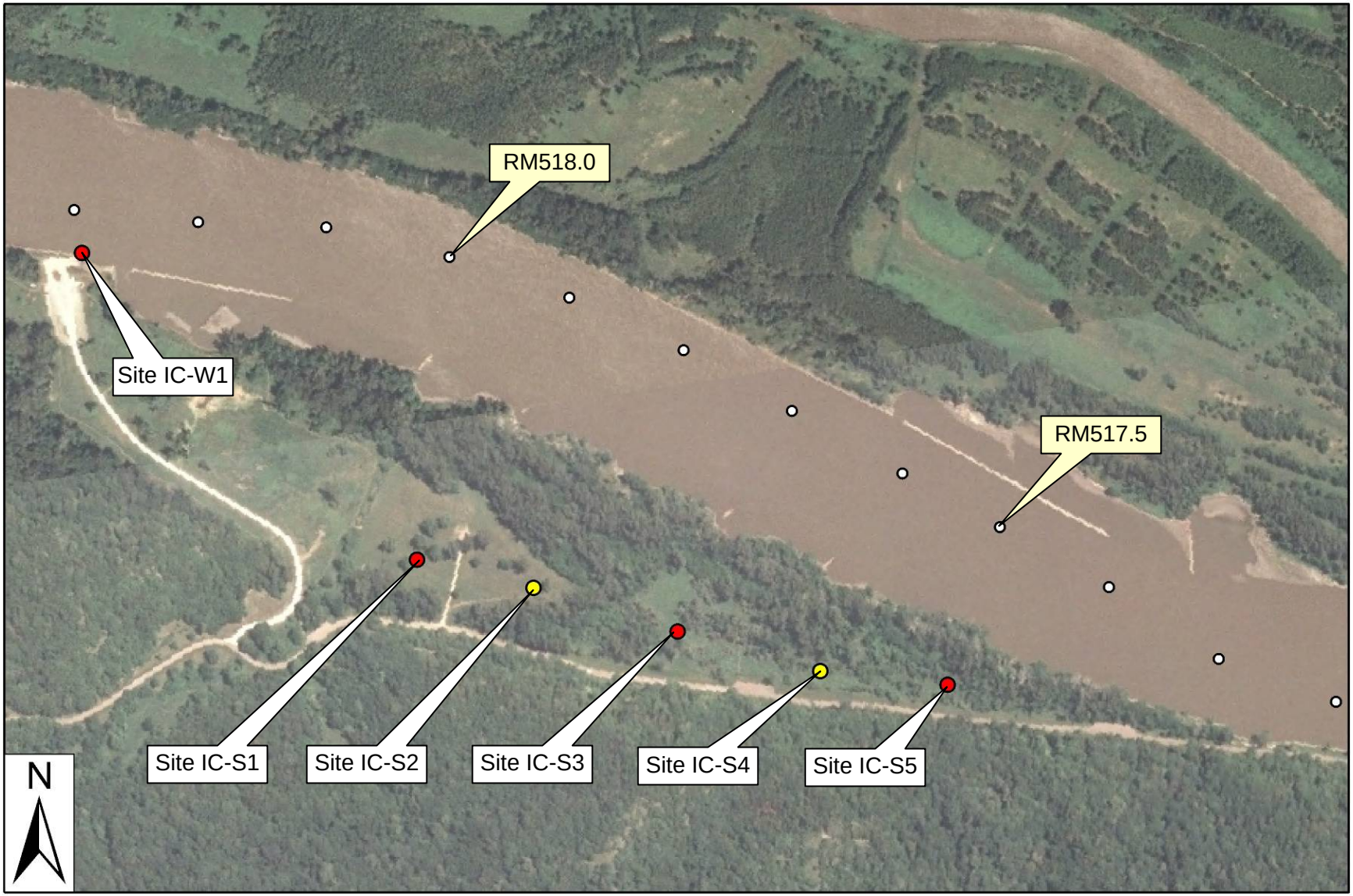
8. REFERENCES

USEPA and USACE. 1998. Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Test Manual: Inland Testing Manual. EPA-823-B-98-004, February 1998. U.S. Environmental Protection Agency, Office of Water. Department of Army, U.S. Army Corps of Engineers. Washington, D.C

ATTACHMENT 1. Indian Cave Project Area.



ATTACHMENT 2. Indian Cave Project Sampling Sites.



Attachment 3. Field Sheet for Indian Cave Elutriate Monitoring Project.

(U.S. Army Corps of Engineers – Omaha District – Water Quality Unit)

FIELD DATA SHEET

Project Name: Indian Cave Elutriate Monitoring **Project Number:** SPS-INCAVE-001

Trip Number: _____ **Date:** _____

Site Location: Indian Cave Project, Missouri River (RM815)

Site Numbers: IC-W1**,** IC-S1, IC-S2, IC-S3, IC-S4, IC-S5

Collectors: _____

GPS MEASUREMENTS

GPS Device Used: _____

Site IC-W1: Latitude: _____ Longitude: _____

Site IC-S1: Latitude: _____ Longitude: _____

Site IC-S2: Latitude: _____ Longitude: _____

Site IC-S3: Latitude: _____ Longitude: _____

Site IC-S4: Latitude: _____ Longitude: _____

Site IC-S5: Latitude: _____ Longitude: _____

WATER MEASUREMENTS

Water Quality Measurements:

Temp. (°C)	pH (S.U.)	Cond. (umho/cm)	D.O. (%Sat)	D.O. (mg/l)	Turbidity (NTUs)

SAMPLES COLLECTED

Sample Type	Sample ID	Sampled Depth	Collection Time	Sampling Method
Water Sample	IC-W1	Surface		Grab
Soil Sample	IC-S1			Composite Core
Soil Sample *(Bacteria Only)*	IC-S2			Composite Core
Soil Sample	IC-S3			Composite Core
Soil Sample *(Bacteria Only)*	IC-S4			Composite Core
Soil Sample	IC-S5			Composite Core

COMMENTS:

Attachment 4. Analytical Request Form for Deer Island Elutriate Monitoring Project.

(U.S. Army Corps of Engineers – Omaha District – Water Quality Unit)

ANALYTICAL REQUEST FORM

Project Name: Deer Island Elutriate Monitoring **Project Number:** SPS-DEERID-001

Trip Number: _____

Samples to be Analyzed:

Site Number	Sample Description	Sample Identification Number	Collection Date	Collection Time	Number of Sample Containers
IC-W1	Missouri River Overburden Water	IC-W1			13*
IC-S1	Soil Sample	IC-S1			1
IC-S2	Soil Sample *(Bacteria Only)*	IC-S2			1
IC-S3	Soil Sample	IC-S3			1
IC-S4	Soil Sample *(Bacteria Only)*	IC-S4			1
IC-S5	Soil Sample	IC-S5			1

* Assuming 1-gallon containers

Total Number of Sample Containers Delivered to Lab: _____

Samples Collected By: _____

Samples Delivered By: _____

Samples Received By: _____ **Date/Time Received:** _____

REQUESTED LABORATORY ANALYSES
(See Back of Page)

Comments:

REQUESTED LABORATORY ANALYSES				
Parameter	**Detection Limit**	**Soil**	**Receiving Water**	**Elutriate Water**
PHYSICAL AND AGGREGATE PROPERTIES				
pH	----	X		X
Particle Size	-----	X		
Total Suspended Solids	4 mg/l		X	X*
Turbidity	1 NTU			X*
NUTRIENTS				
Nitrogen, Ammonia as N, Total	0.02 mg/l	X	X	X*
Nitrogen, Total Kjeldahl as N	0.2 mg/l	X	X	X*
Nitrogen, Nitrate/Nitrite as N)	0.02 mg/l	X	X	X
Phosphorus, Dissolved	0.02 mg/l		X	X
Phosphorus, Total	0.02 mg/l	X	X	X*
Ortho-Phosphorus, Dissolved	0.02 mg/l		X	X
AGGREGATE ORGANIC CONSTITUENTS				
CBOD	1 mg/l		X	X*
Chemical Oxygen Demand	3 mg/l		X	X
Organic Carbon, Total	0.4 mg/l	X	X	X*
METALS (Dissolved)				
Arsenic, Dissolved	1 ug/l		X	X
Cadmium, Dissolved	0.2 ug/l		X	X
Chromium, Dissolved	10 ug/l		X	X
Copper, Dissolved	2 ug/l		X	X
Lead, Dissolved	0.5 ug/l		X	X
Mercury, Dissolved	0.05 ug/l		X	X
Nickel, Dissolved	10 ug/l		X	X
Zinc Dissolved	10 ug/l		X	X
METALS (Total)				
Arsenic, Total	10 mg/kg	X		
Cadmium, Total	0.2 mg/kg	X		
Chromium, Total	1 mg/kg	X		
Copper, Total	1 mg/kg	X		
Lead, Total	13 mg/kg	X		
Mercury, Total	0.1 mg/kg	X		
Nickel, Total	1 mg/kg	X		
Zinc Total	2 mg/kg	X		
PESTICIDES and PCBs				
Organochlorine Pesticide and PCB Scan	------	X	X	X*
Atrazine (ug/l)	0.05	X	X	X*
Dieldrin	0.001ug/l		X	X*
PCBs – Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (ug/l)	0.001ug/l		X	X*

* Determined on the “elutriate” supernatant prior to filtration.

ATTACHMENT 2.

Sampling and Analysis Plan for 2013 Elutriate Testing

at the

Proposed Indian Cave State Park Shallow Water Habitat Site

QUALITY CONTROL PLAN

for

2013 Elutriate Sampling – Missouri River
Indian Cave State Park SWH Project Area

Project Number: SPS-INCAVE-002

Prepared By:

Water Control and Water Quality Section
Hydrologic Engineering Branch
U.S. Army Corps of Engineers – Omaha District

April 2013

USACE – Water Quality Unit Sampling Coordinator	18-APR-13 Date
USACE – Water Quality Unit Team Leader	17-Apr-2013 Date
USACE – Chief, Water Control and Water Quality Section	24 Apr 2013 Date
USACE – Chief, Sedimentation & Channel Stabilization Section	18-Apr-2013 Date
USACE – (CENWO-PM-AE)	17-Apr-2013 Date

Distribution List:

U.S. Army Corps of Engineers – Omaha District – ED – Hydrologic Engineering Branch

Dave Jensen (Water Quality Unit)
Bill Otto (Water Quality Unit)
John Hargrave (Water Quality Unit)
Dan Pridal (Sedimentation & Channel Stabilization Section)

U.S. Army Corps of Engineers – Omaha District – (CENWO-PM-AE)

Luke Wallace
Scott Flash

TABLE OF CONTENTS

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1. PROJECT/TASK ORGANIZATION AND RESPONSIBILITIES

The Omaha District's Water Control and Water Quality Section will conduct the sediment/soil sampling required to facilitate elutriate testing and bacterial analysis of prospective dredge material at the proposed Indian Cave State Park shallow-water habitat (SWH) project area. Collected samples will be delivered to Midwest Laboratories, Inc. Omaha, NE for preparation and analysis of elutriate samples.

Staff Responsibilities and Contacts for Sampling:

Sample Collection: Dave Jensen (995-2310), Bill Otto (995-2313), John Hargrave (995-2347)
Sampling Coordination: Dave Jensen
Data Quality Review: Dave Jensen
Water Quality Sampling Report and Factual Determinations: Dave Jensen
Laboratory Analysis: Midwest Laboratories, Prem Arora (402-829-9878)
Indian Cave State Park SWH Project Coordinator: Scott Flash

2. PROJECT DESCRIPTION

2.1. BACKGROUND INFORMATION

A project is being proposed to create SWH along the Missouri River in Richardson County, Nebraska. The Omaha District (District) is referring to this proposed project as the Indian Cave State Park project. Soil will be excavated from an old chute area to create SWH. Construction of the SWH will involve dredging with the dredge spoil being discharged to the adjacent Missouri River. It is believed the dredge material will be primarily sands, silts and clays. The proposed area to be excavated was inundated during the 2011 flooding along the Missouri River and was likely covered with new flood deposited material.

2.1.1. Project Location

The proposed Indian Cave State Park project site is located along the Lower Derion and Indian Cave Bends of the Missouri River between RM517 and RM518 (Figure 1). The proposed project site is within the boundaries of Indian Cave State Park. Figure 2 indicates the proposed areas to be excavated at the Indian Cave State Park project site.

2.1.2. 404 Permitting Requirements

The requirements for a U.S. Army Corps of Engineers (USACE) individual Section 404 permit must be met for the proposed dredging activity. To meet the Section 404 Individual Permit requirements, a Section 401 Certification will be requested from the Nebraska Department of Environmental Quality (NDEQ) that the proposed actions will not "violate" water quality standards. To facilitate review of the proposed project for Section 401 Certification, "elutriate testing" of sediment/soil collected from the proposed dredging site will be conducted. This monitoring project plan was developed to collect the appropriate samples for elutriate testing pursuant to the U.S. Environmental Protection Agency (EPA) and USACE guidance document, "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – *Inland Testing Manual"* (USEPA and USACE, 1998).

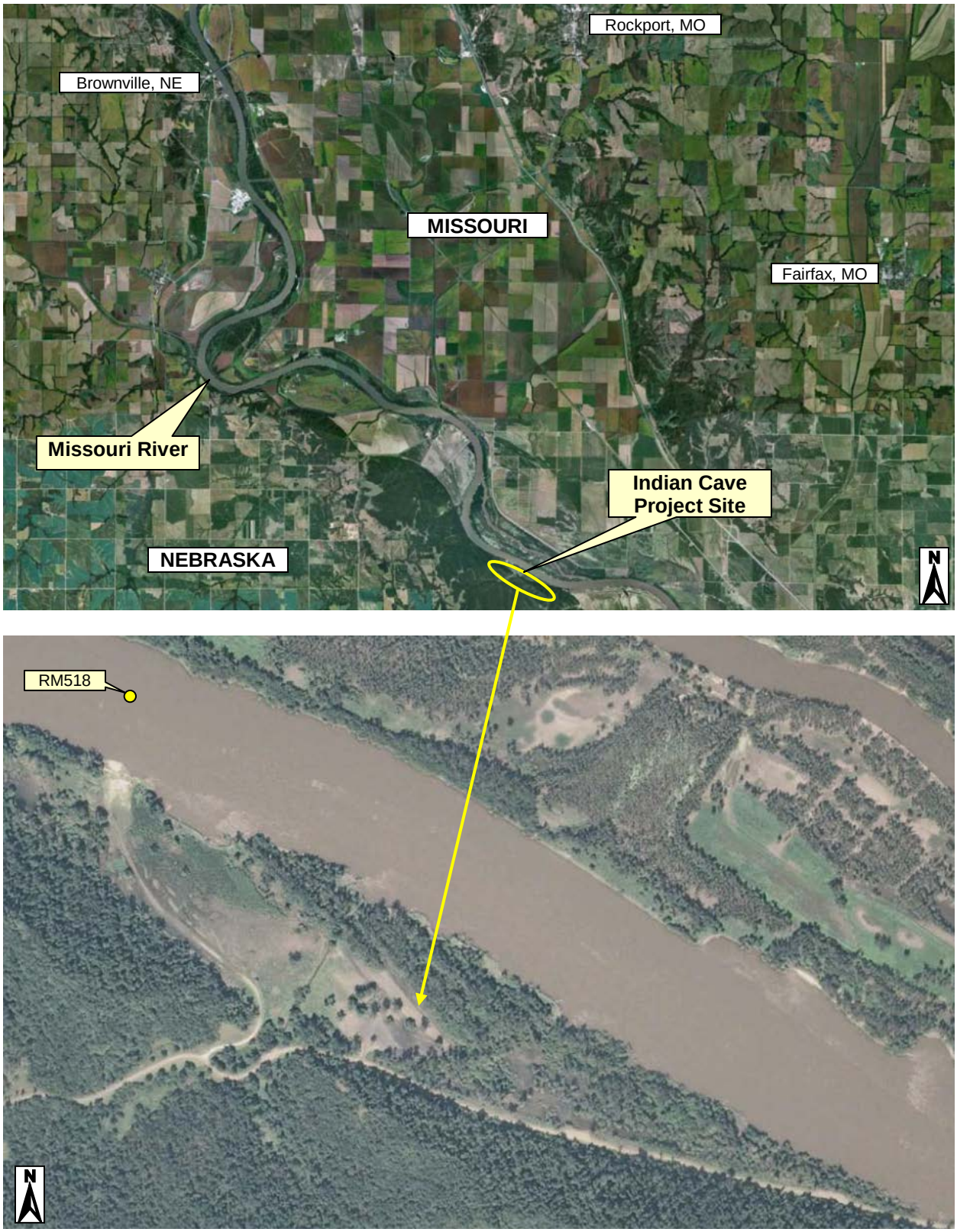

Figure 1. Location of proposed Indian Cave State Park shallow-water habitat project site. *(Shown on 8-July-2010 aerial photo, Google Earth).*

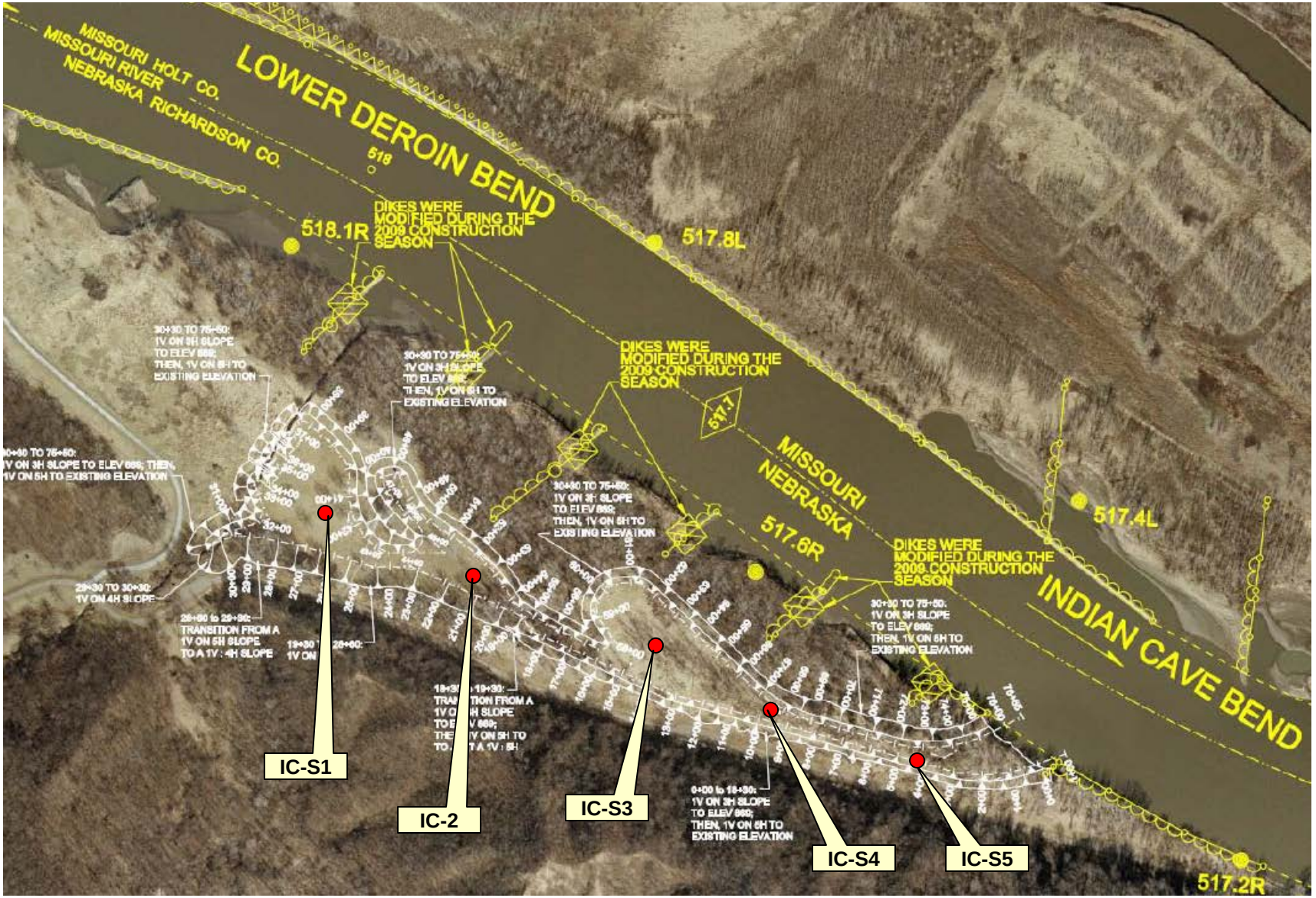

Figure 2. Proposed areas for excavation to construct shallow-water habitat at the proposed Indian Cave State Park project site. Locations where sediment samples will be collected for analysis are shown (i.e. IC-S1, IC-S2, IC-S3, IC-S4, and IC-S5).

2.1.3. Previous Analysis and Elutriate Testing of Sediment Samples Collected at the Proposed Indian Cave State Park Project Site

Sediment samples were previously collected at the proposed Indian Cave State Park project site in May 2011, and were subjected to elutriate testing. The sediment samples were collected just prior to the 2011 flooding that occurred along the Missouri River and inundated the proposed Indian Cave State Park project site. The NDEQ has asked that additional sediment/soil samples be collected and subjected to elutriate testing and bacterial analysis to assess newly deposited sediment at the site from the 2011 flooding.

3. SITE-SPECIFIC WATER QUALITY CONCERNS

3.1. SECTION 303(D) IMPAIRED WATERS LISTINGS

Nebraska's water quality standards identify the Missouri River from the Platte River to the NE-KS state line as designated Segment NE1-10000. Segment NE1-10000 is listed on Nebraska's 2012 Section 303(d) list as impaired due to a fish consumption advisory and *E. coli*.

After the NDEQ published their 2012 Integrated Water Quality Report and Section 303(d) list on 1-April-2012 that listed Segment MT1-10000 as impaired due to the fish consumption advisory in effect, the NDEQ published the report, "Findings of the 2010 Regional Ambient Fish Tissue Program in Nebraska" in June, 2012 (NDEQ, 2012). That report indicated that Dieldrin and PCBs were no longer a fish tissue concern on Segment MT1-10000. This resulted in the fish consumption advisory for the Missouri River regarding Dieldrin and PCBs being removed. Based on the removal of the fish consumption advisory for the Missouri River, the NDEQ has indicated that the 303(d) listing of the Missouri River for Dieldrin and PCBs will be removed in the next published 303(d) listing (personal communication NDEQ). As such, the Missouri River in the area of the proposed Indian Cave State Park project site will not be identified as impaired from Cancer Risk & Hazardous Index Compounds (i.e. Dieldrin and PCBs) by Nebraska's next 303(d) list of impaired waters. Personnel communication with NDEQ has indicated that elutriate testing for Dieldrin and PCBs to a detection limit of 0.4 parts-per-trillion is no longer required.

A Total maximum Daily Load (TMDL) was approved in September 2007 on Segment NE1-10000 for *E. coli* bacteria. To protect the designated recreational use of the Missouri River, *E. coli bacteria levels are not to exceed a geometric mean of 126/100ml based on a minimum of 5 samples taken within a 30-day period.* This criterion applies to the designated recreational period of May 1 through September 30.

3.2. NUTRIENTS

Concerns have been expressed regarding the nutrient enrichment and loading that the proposed dredging for SWH construction might pose to the Missouri River and ultimately to the Gulf of Mexico. Currently, no numeric water quality standards criteria have been promulgated by the State of Nebraska for the Missouri River regarding nutrient enrichment. For background information, nutrient analysis will be included in the elutriate testing of sediment/soil samples collected at the proposed Indian Cave State Park project site.

4. DATA QUALITY OBJECTIVES

A Water Quality Sampling Report and Factual Determinations will be prepared that compiles sediment analyses and elutriate testing of pre-2011 flood and post-2011flood collected sediment/soil samples at the Indian Cave State Park project site. The information will be used assess the water quality impacts the proposed hydraulic dredging at the project site poses to the Missouri River. The report will be provided to the NDEQ to facilitate appropriate Section 401 water quality certification review of the proposed dredging project by the State of Nebraska. The report will also be used by the District to finalize the dredging plan for construction of SWH at the proposed Indian Cave State Park project site.

5. DATA COLLECTION APPROACH

5.1. SAMPLING LOCATIONS

Sediment/soil samples will be collected at 5 sites: IC-S1, IC-S2, IC-S3, IC-S4, and IC-S5 (Table 1). The locations of the five sediment/soil sampling sites are shown in Figures 2 and 3. Receiving water (Missouri River) samples will be collected at the Indian Cave State Park boat ramp, site IC-W1 (Figure 3). Sites IC-S1 and IC-S3 are approximate, as these sites will be selected in the field to sample significant areas of deposition from the 2011 flood. The "actual" locations of all the sampled sites will be determined with a GPS unit in the field when the samples are collected and recorded on a field sheet (Attachment 1).

Table 1. Geo-referenced locations of sediment/soil sampling sites at the proposed Indian Cave State Park project site.

Site	Sample Type*	Latitude	Longitude
IC-S1	E, B	40° 15' 06.5"	95° 32' 08.5"
IC-S2	B	40° 15' 04.3"	95° 32' 02.7"
IC-S3	E, B	40° 15' 02.5"	95° 31' 55.6"
IC-S4	B	40° 14' 59.8"	95° 31' 47.7"
IC-S5	B	40° 14' 58.6"	95° 31' 41.0"

* E = sediment collected for elutriate testing.
B = sediment collected for *E. Coli* bacteria analysis.

5.2. MEASUREMENT AND SAMPLING METHODS

5.2.1. Receiving Water Sample

Water collected from the Missouri River near the project site (i.e., receiving water) will be used for elutriate testing. The laboratory requires 4 parts receiving water for each 1 part of soil/sediment to be analyzed. In addition to the 4 parts of water for each 1 part soil/sediment, additional receiving water is required for analysis. The receiving water will be collected at the Indian Cave State Park boat ramp (Site IC-W1) (Figure 3).

At the time the receiving water is collected, the following field measurements will be taken: water temperature, dissolved oxygen (mg/L and % saturation), pH, specific conductance, and turbidity. These measurements will be obtained with a "HydroLab" equipped with a MS5 DataSonde and Surveyor data logger. Measurements will be taken by immersion of the DataSonde directly into the river. Measurements will be appropriately recorded on a field sheet (Attachment 1).

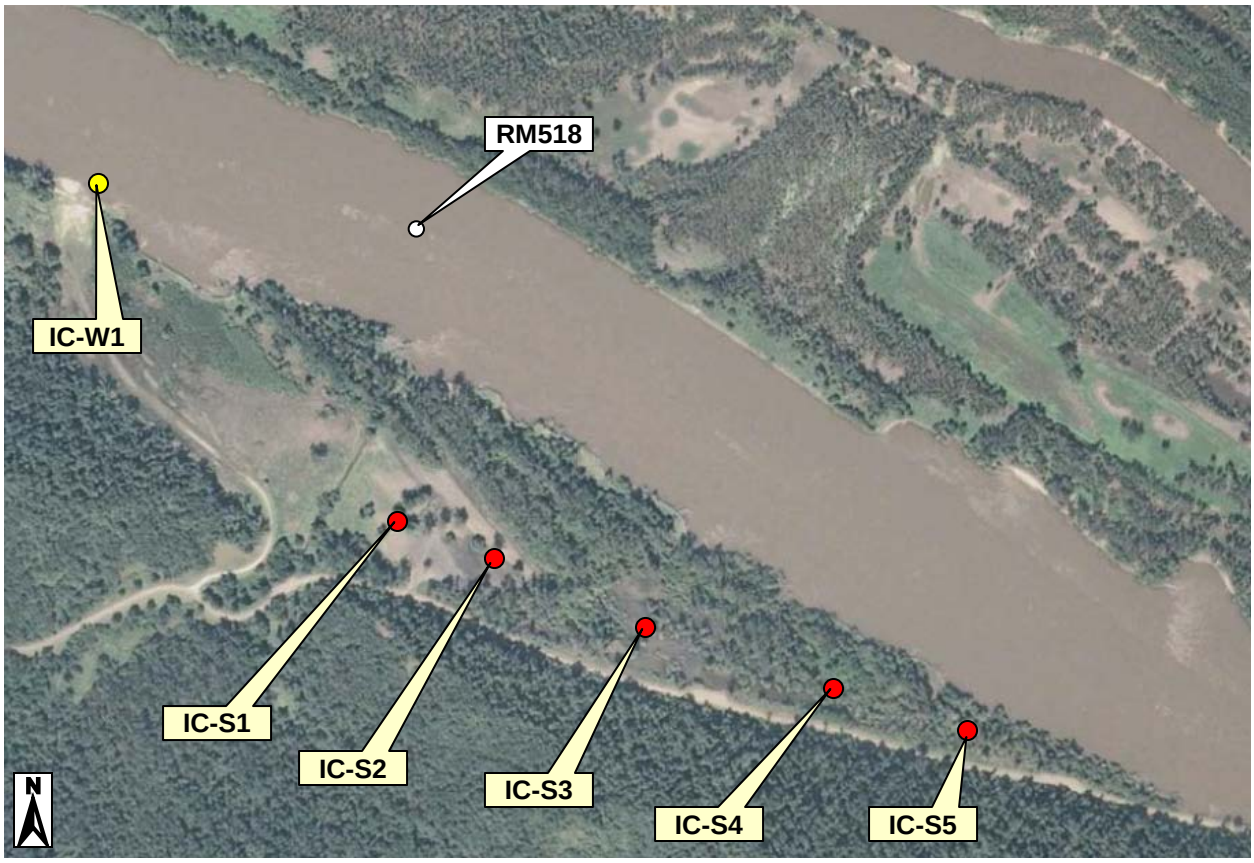

Figure 3. Locations of sites where receiving water and sediment/soil samples will be collected for analysis and elutriate testing. *(Shown on 8-July-2010 aerial photo, Google Earth)*

5.2.2. Sediment/Soil Samples for Elutriate Testing

Sediment/soil samples for elutriate testing will be collected at Sites IC-S1 and IC-S3. The equipment, supplies, and procedures to be used to collect the sediment/soil samples for elutriate testing are as follows.

5.2.2.1. Equipment and Supplies

1) Gas powered auger head
2) Stainless steel coring device
3) Gasoline
4) 1-gallon wide-mouth glass jars
5) 1-gallon narrow-mouth glass jugs
6) Sample bottle labels
7) ARF/COC
8) Field Sheets
9) GPS device
10) 5-gallon buckets
11) Shovel
12) Miscellaneous tools to remove collected sediment from coring device (i.e., wood stakes, mallet, screwdriver, putty knife, etc.)
13) Scrub brush

5.2.2.2. Sediment/Soil Collection Procedure

1) Select sample site and record general information (including Latitude/Longitude) on the field sheet.
2) Remove any vegetation near the proposed boring site (2-3 foot diameter circle).
3) Set out equipment near the boring site. Take care to keep extraneous material out of the sample collection bucket.
4) Attach the corer to the auger head, bore down and collect sample in approximately one-foot increments.
5) After each coring, detach the device from the gas auger, suspend the corer over the sample collection bucket and deposit the collected material into the 5-gallon collection bucket.
6) Heavy clays may require a screwdriver, hammer and/or wooden stake or other tools to remove the sample from the corer.
7) When all cores for one sediment/soil sample have been collected in the bucket, homogenize the contents and fill a 1-gallon, wide-mouth glass jar. Affixing the sample label to the jar prior to filling it with the sample ensures good adhesion.
8) Clean the coring device, tools and sample collection bucket between sample collections.
9) Deliver the samples and an analytical request form or chain-of-custody to the laboratory analyzing the samples.

5.2.3. Sediment/Soil Samples for *E. coli* Bacteria Analysis

Sediment/soil samples for *E. coli* bacteria analysis will be collected at Sites IC-S1, IC-S2, IC-S3, IC-S4, and IC-S5. The equipment, supplies, and procedures to be used to collect the sediment/soil samples for *E. coli* bacteria analysis are as follows.

1) Select sample site and record general information (including Latitude/Longitude) on the field sheet.
2) Remove any vegetation near the proposed sampling site.
3) Using shovel dig down ½ foot and mix sediment/soil.
4) Fill a sterilized/treated plastic bacteria bottle with mixed soil.

5.2.4. Preparation of Elutriate Samples

Elutriate testing will been done on sediment/soil samples collected at Sites IC-S1 and IC-S3. The procedures that will be used to process collected sediment/soil samples for elutriate testing is depicted in Figure 4.

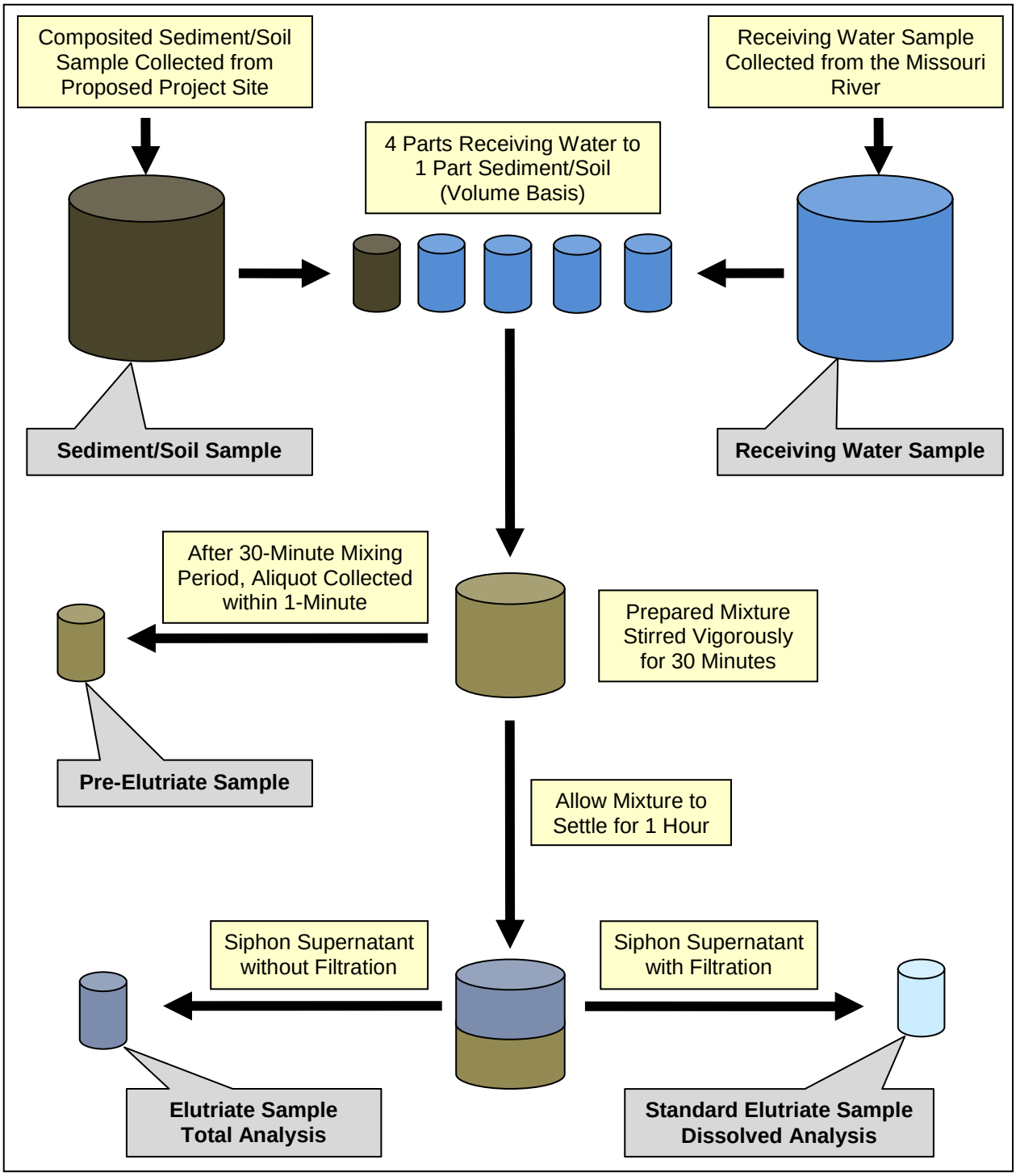

Figure 4. Procedures to be used to process collected sediment/soil samples for elutriate testing.

5.2.4.1. Standard Elutriate Samples

Standard elutriate samples will be prepared in accordance with the "*Inland Testing Manual*." Elutriate sample will be prepared by using receiving water collected from the Missouri

River at site IC-W1. The sample is prepared in the laboratory by sub-sampling approximately 1-liter of the collected sediment/soil sample from the well-mixed original sample. The sediment material and unfiltered receiving water were then combined in a sediment-to-water ratio of 1:4 on a volume basis at room temperature (22 ± 2°C). The 1:4 sediment-to-water ratio is believed to represent "end-of-pipe" discharge conditions for hydraulic dredging**.** After the correct ratio is achieved, the mixture is stirred vigorously for 30 minutes with a mechanical stirrer/shaker. After the 30-minute mixing period, the mixture is allowed to settle for one hour. The supernatant is then siphoned off without disturbing the settled material. Analysis for total constituents is done on the supernatant without filtration, and the supernatant is filtered through a 0.45-micron filter for analysis of dissolved constituents. The filtered water is the standard elutriate sample identified by the *"Inland Testing Manual"* and represents the dissolved constituents that could be released from dredged material during the hydraulic dredging process.

5.2.4.2. Pre-Elutriate Samples

Pre-elutriate samples will be prepared for analysis of selected constituents. The pre-elutriate samples are prepared the same as standard elutriate samples through the point of the 30-minute mixing period. At that time an aliquot of water is immediately drawn off the mixed solution and identified as the pre-elutriate sample. The pre-elutriate sample is believed to represent conditions of the "end-of-pipe" hydraulic dredging discharge slurry prior to any mixing with the receiving water (i.e. Missouri River).

5.3. SAMPLE HANDLING, CUSTODY, AND TRANSPORT

The collected samples will be transported by sampling personnel to Midwest Laboratories, Inc. in Omaha, Nebraska for elutriate testing and analysis. A Chain-of-Custody (COC) will be completed and submitted with the samples delivered to the laboratory.

5.3.1. Sample Handling, Transport, and Delivery to the Laboratory

Upon completion of sample collection, preservation, and labeling, those samples requiring chilling to 4° C should be stored in an iced cooler. Samples not requiring cooling can be stored by any convenient, but non-contaminable method. Samples are to be at all times stored in an upright condition. Samples will be transported by Water Quality Unit personnel directly Midwest Laboratories.

A COC will be completed and submitted with all samples delivered to Midwest Laboratories. Laboratory personnel should be alerted an appropriate time in advance of when samples are going to be delivered so any necessary arrangements for sample receipt by Midwest Laboratories can be made.

Samples delivered to Midwest Laboratories by Water Quality Unit personnel will be taken to a staging area and grouped by sample location. This will provide an accurate count of sample bottles delivered and allow for ease of log in by laboratory personnel. Laboratory personnel will compare the physical samples to information on COC, sign and date the form, and provide a copy. The original COC form will be retained by the laboratory. Once samples are logged-in they are to be maintained at 4° C until analysis is completed. Sample water is typically retained for at least 30 days beyond analysis.

5.4. PARAMETERS TO BE MEASURED

The parameters that will be measured or analyzed for the different types of samples are listed in Table 2.

5.5. LABORATORY ANALYTICAL METHODS AND COSTS

Table 3 provides methods, detection limits, and costs for parameters to be analyzed on collected sediment/soil samples. Table 5 provides methods, detection limits, and costs for parameters to be analyzed on pre-elutriate samples. Table 7 provides methods, detection limits, and costs for parameters to be analyzed on standard filtered elutriate samples. Table 8 provides methods, detection limits, and costs for parameters to be analyzed on non-filtered elutriate samples. Table 10 provides methods, detection limits, and costs for parameters to be analyzed on receiving water.

5.6. QUALITY CONTROL

5.6.1. Adherence to Standard Operating Procedures and Quality Control Plans

Where applicable, field measurements and samples will be collected in accordance with SOPs developed by the Omaha District's Water Control and Water Quality Section.

Laboratory quality control samples and data quality indicators will be utilized in accordance with Midwest Laboratory's Quality Assurance Manual. Routine internal quality control checks are placed in the measurement system to assess the quality of the data generated. These checks typically include: with each preparative batch, a Method Blank, a Matrix Spike and Matrix Spike Duplicate, a Laboratory Duplicate, and a Laboratory Control Sample. Inclusion of the Matrix Spike, Matrix Spike Duplicate and Laboratory Duplicate are contingent on sufficient sample material being provided. In addition to the checks within the preparative batch there are analysis batch checks that are also completed (retained on file by the laboratory, but typically not reported in a standard data package) including Calibration Blanks, Initial Calibration Verifications, and Continuing Calibration Verifications. Additional samples are analyzed periodically (results retained on file) and may include reagent blanks, second source check standards and other performance checks. External quality control checks are provided in the form of Performance and System Audits and Surveillance. A laboratory Quality Assurance Report will be submitted to the District's Water Quality Unit on an appropriate basis.

5.6.2. Data Quality Review

All water quality measurements and analyses will be verified, validated, and compiled in accordance with SOP WQ-27202: Data Quality Review.

Table 2. Parameters to be measured and analyzed.

Parameter	Soil	Receiving Water	Pre-Elutriate Water	Elutriate Water	
				Non-Filtered	Filtered
FIELD MEASUREMENTS					
Water Temperature (°C)		X			
Dissolved Oxygen (mg/L and % Sat)		X			
pH (S.U.)		X			
Specific Conductance (µS/cm)		X			
Turbidity		X			
PHYSICAL AND AGGREGATE PROPERTIES					
Particle Size	X				
pH	X				X
Total Suspended Solids		X	X	X	
Turbidity			X	X	
NUTRIENTS					
Nitrogen, Ammonia as N	X	X	X	X	X
Nitrogen, Nitrate/Nitrite as N)	X	X	X		X
Nitrogen, Total Kjeldahl as N	X	X	X	X	
Phosphorus, Dissolved		X			X
Phosphorus, Orthophosphate		X			X
Phosphorus, Total	X	X	X	X	
AGGREGATE ORGANIC CONSTITUENTS					
CBOD		X	X	X	
Chemical Oxygen Demand		X	X	X	
Organic Carbon, Total	X	X	X	X	
METALS (Dissolved)					
Dissolved Metals Scan		X			X
METALS (Total)					
Total Metals Scan	-----	X	X	X	
Arsenic, Total	X				
Cadmium, Total	X				
Chromium, Total	X				
Copper, Total	X				
Lead, Total	X				
Mercury, Total	X				
Nickel, Total	X				
Zinc Total	X				
PESTICIDES and PCBs					
Atrazine	X	X		X	
Organochlorine Pesticide/PCB Scan	X	X		X	

Table. 3. Parameters to be Analyzed on Collected Sediment/Soil Samples and Unit Costs.

Parameter	Method	Detection Limit	Analytical Cost
PHYSICAL AND AGGREGATE PROPERTIES			
Particle Size	Sieve (Minimum Sieve #200)	0.001 mm	$60.00
pH	EPA 150.1	0.1 S.U.*	12.00
NUTRIENTS			
Nitrogen, Ammonia Total as N	EPA 350.1	0.02 mg/kg	17.70
Nitrogen, Kjeldahl Total as N	EPA 351.3	0.2 mg/kg	27.50
Nitrogen, Nitrate/Nitrite Total as N	EPA 353.2	0.02 mg/kg	13.00
Phosphorus, Total	SM4500PF	0.02 mg/kg	27.00
AGGREGATE ORGANIC CONSTITUENTS			
Total Organic Carbon	EPA 415.1	0.4 mg/kg	22.00
TOTAL METALS			
Arsenic, Total	EPA 6010B	10 mg/kg	12.75
Cadmium, Total	EPA 6010B	0.2 mg/kg	12.75
Chromium, Total	EPA 6010B	1 mg/kg	12.75
Copper, Total	EPA 6010B	1 mg/kg	12.75
Lead, Total	EPA 6010B	13 mg/kg	12.75
Mercury, Total	EPA 6010B	0.1 mg/kg	12.75
Nickel, Total	EPA 6010B	1 mg/kg	12.75
Zinc Total	EPA 6010B	2 mg/kg	12.75
PESTICIDES AND PCBs			
Atrazine, Total	EPA 507	0.05 mg/kg	150.00
Organochlorine Pesticide and PCB Scan	EPA 8081 and EPA 8082	See Table 4	180.00
		Total Laboratory Cost for Analyzing a Soil Sample	**$611.20**

* Resolution limit.

Table 4. Detection and Reporting Limits for individual parameters included in the Organochlorine Pesticide and PCB Scan of sediment/soil samples.

Parameter	Detection Limit (µg/kg)	Reporting Limit (µg/kg)	Parameter	Detection Limit (µg/kg)	Reporting Limit (µg/kg)
DDE	0.8	9.9	Alpha-BHC (alpha-Lindane)	0.4	5.1
DDD	0.7	9.9	Beta-BHC (beta-Lindane)	1.0	5.1
DDT	1.0	9.9	Delta-BHC (delta-Lindane)	1.8	5.1
Methoxychlor	1.2	5.1	Gamma-BHC (gamma-Lindane)	0.6	5.1
Aldrin	0.7	5.1	Gamma-Chlordane	0.8	5.1
Dieldrin	0.7	9.9	PCB - Aroclor1016	10	50
Endosulfan 1	0.7	5.1	PCB - Aroclor1260	10	50
Endosulfan 2	0.8	9.9	PCB - Aroclor1221	10	50
Endosulfan Sulfate	1.0	9.9	PCB - Aroclor1248	10	50
Endrin	1.0	9.9	PCB - Aroclor1268	10	50
Endrin Aldehyde	1.0	9.9	PCB - Aroclor1232	10	50
Endrin Ketone	0.8	9.9	PCB - Aroclor1254	10	50
Heptachlor	0.6	5.1	PCB - Aroclor1242	10	50
Heptachlor Epoxide	0.8	5.1	PCB - Aroclor1262	10	50
Alpha-Chlordane	0.8	5.1			

Table. 5. Parameters to be Analyzed in Pre-Elutriate Water Samples and Unit Costs.

Parameter*	Method	Detection Limit	Analytical Cost
PHYSICAL AND AGGREGATE PROPERTIES			
Total Suspended Solids	EPA 160.1	5 mg/l	$10.90
Turbidity	EPA 180.1	1 NTU	13.50
NUTRIENTS			
Nitrogen, Ammonia as N,	EPA 350.1	0.02 mg/l	17.70
Nitrogen, Total Kjeldahl as N	EPA 351.3	0.2 mg/l	20.55
Nitrogen, Nitrate/Nitrite as N	EPA 353.2	0.02 mg/l	13.25
Phosphorus, Total	SM4500PF	0.02 mg/l	18.80
AGGREGATE ORGANIC CONSTITUENTS			
CBOD	SM 5210.B	1 mg/l	29.10
Chemical Oxygen Demand	ASTM D1252	3 mg/l	18.20
Organic Carbon, Total	EPA 415.1	0.4 mg/l	26.50
METALS			
Total Metals Scan	EPA 6010B	See Table 6	168.30
Total Laboratory Cost for Analyzing a Pre-Elutriate Water Sample			**$336.80**

Table 6. Detection and Reporting Limits for individual metals included in the Total and Dissolved Metals Scan of analyzed water samples.

Metal	Detection Limit (µg/l)	Reporting Limit (µg/l)	Metal	Detection Limit (µg/l)	Reporting Limit (µg/l)
Aluminum	20	50	Lead	0.5	2
Antimony	0.03	0.5	Magnesium	1,000	3,000
Arsenic	1	3	Manganese	2	10
Beryllium	0.2	1	Mercury	0.02	0.05
Cadmium	0.2	1	Nickel	2	10
Calcium	1,000	3,000	Selenium	0.4	1
Chromium III	4	10	Silver	0.05	1
Copper	2	10	Thallium	0.05	0.5
Iron	5	50	Zinc	2	10

Table 7. Parameters to be Analyzed in Standard Filtered Elutriate Water Samples and Unit Costs.

Parameter	Method	Detection Limit	Analytical Cost
SAMPLE PREPARATION			
Elutriate Sample Preparation	1:4 Sediment:Receiving Water	-----	$178.50
PHYSICAL AND AGGREGATE PROPERTIES			
pH	EPA 150.1	0.1 S.U.*	7.45
NUTRIENTS			
Nitrogen, Ammonia as N	EPA 350.1	0.02 mg/l	17.70
Nitrogen, Nitrate/Nitrite as N (mg/l)	EPA 353.2	0.02 mg/l	13.35
Phosphorus, Dissolved	SM4500PF	0.02 mg/l	18.80
Ortho-Phosphorus, Dissolved	EPA 365.1	0.02 mg/l	14.30
METALS			
Dissolved Metals Scan	EPA 6010B	See Table 6	$168.30
Total Laboratory Cost for Analyzing a Standard Filtered Elutriate Water Sample			**$418.40**

* Resolution limit.

Table. 8. Parameters to be Analyzed in Non-Filtered Elutriate Water Samples and Unit Costs.

Parameter*	Method	Detection Limit	Analytical Cost
PHYSICAL AND AGGREGATE PROPERTIES			
Total Suspended Solids	EPA 160.1	5 mg/l	$10.95
Turbidity	EPA 180.1	1 NTU	13.55
NUTRIENTS			
Nitrogen, Ammonia as N	EPA 350.1	0.02 mg/l	17.70
Nitrogen, Total Kjeldahl as N	EPA 351.3	0.2 mg/l	20.55
Nitrogen, Nitrate-Nitrite as N	EPA 353.2	0.02 mg/l	13.25
Phosphorus, Total	SM4500PF	0.02 mg/l	18.80
AGGREGATE ORGANIC CONSTITUENTS			
CBOD	SM 5210.B	1 mg/l	29.15
Chemical Oxygen Demand	ASTM D1252	3 mg/l	18.20
Organic Carbon, Total	EPA 415.1	0.4 mg/l	26.55
METALS TOTAL			
Total Metals Scan	EPA 6010B	See Table 6	$168.30
PESTICIDES and PCBs			
Atrazine (Immunoassay by Elisa)	Fluorometry	0.1 μg/L	23.50
Organochlorine Pesticide and PCB Scan (ug/l)	EPA 8081 EPA 8082	See Table 9	180.00
Total Laboratory Cost for Analyzing a Pre-Elutriate Water Sample			**$540.50**

Table 9. Detection and Reporting Limits for individual parameters included in the Organochlorine Pesticide and PCB Scan of water samples.

Parameter	Detection Limit (µg/l)	Reporting Limit (µg/l)	Parameter	Detection Limit (µg/l)	Reporting Limit (µg/l)
DDE	0.005	0.1	Alpha-BHC (alpha-Lindane)	0.009	0.05
DDD	0.005	0.1	Beta-BHC (beta-Lindane)	0.009	0.05
DDT	0.004	0.1	Delta-BHC (delta-Lindane)	0.014	0.05
Methoxychlor	0.005	0.5	Gamma-BHC (gamma-Lindane)	0.035	0.05
Aldrin	0.008	0.5	Gamma-Chlordane	0.006	0.05
Dieldrin	0.004	0.1	PCB - Aroclor1016	0.2	1.0
Endosulfan 1	0.006	0.05	PCB - Aroclor1260	0.2	1.0
Endosulfan 2	0.003	0.1	PCB - Aroclor1221	0.2	2.0
Endosulfan Sulfate	0.010	0.1	PCB - Aroclor1248	0.3	1.0
Endrin	0.003	0.1	PCB - Aroclor1268	0.3	1.0
Endrin Aldehyde	0.011	0.1	PCB - Aroclor1232	0.2	1.0
Endrin Ketone	0.006	0.1	PCB - Aroclor1254	0.2	1.0
Heptachlor	0.009	0.05	PCB - Aroclor1242	0.2	1.0
Heptachlor Epoxide	0.007	0.05	PCB - Aroclor1262	0.2	1.0
Alpha-Chlordane	0.011	0.05			

Table 10. Parameters to be Analyzed on Receiving Water Sample and Unit Costs.

Parameter	Method	Detection Limit	Analytical Cost
PHYSICAL AND AGGREGATE PROPERTIES			
Total Suspended Solids	EPA 160.2	5 mg/l	10.90
NUTRIENTS			
Nitrogen, Ammonia as N, Total	EPA 350.1	0.02 mg/l	17.70
Nitrogen, Total Kjeldahl as N	EPA 351.3	0.2 mg/l	20.55
Nitrogen, Nitrate/Nitrite as N	EPA 353.2	0.02 mg/l	13.25
Phosphorus, Dissolved	SM4500PF	0.02 mg/l	18.80
Phosphorus, Total	SM4500PF	0.02 mg/l	18.80
Ortho-Phosphorus, Dissolved	EPA 365.1	0.02 mg/l	14.00
AGGREGATE ORGANIC CONSTITUENTS			
Carbonaceous Biochemical Oxygen Demand - CBOD (mg/l)	SM 5210.B	1 mg/l	29.10
Chemical Oxygen Demand	ASTM D1252	3 mg/l	18.20
Organic Carbon, Total	EPA 415.1	0.4 mg/l	26.50
METALS			
Dissolved Metals Scan	EPA 6010B	See Table 6	168.30
Total Metals Scan	EPA 6010B	See Table 6	168.30
PESTICIDES AND PCBs			
Organochlorine Pesticide and PCB Scan	EPA 8081 EPA 8082	See Table 8	180.00
Atrazine (Immunoassay by Elisa)	Fluorometry	0.1 µg/L	23.50
Total Laboratory Cost for Analyzing the Receiving Water Sample			**$727.90**

6. WATER QUALITY SAMPLING REPORT

A Water Quality Sampling Report and Factual Determinations (WQSRFD) will be prepared that provides the results of the elutriate testing conducted on sediment/soil samples collected at the proposed Indian Cave State Park project site. Current and past elutriate testing results will be evaluated to assess potential impacts the proposed hydraulic dredging to construct SWH at the proposed Indian Cave State Park site poses to water quality and nutrient loading in the Missouri River. As appropriate, elutriate results will be:

1) Compared to applicable State water quality standards,
2) Evaluated for degradation of existing water quality conditions in the Missouri River, and
3) Compared to current nutrient loadings in the Missouri River.

The prepared WQSRFD will be subject to a "Peer Review/Report Check Certification" prior to release of the report to the public.

7. PROJECTED COSTS FOR LABOR AND LABORATORY ANALYSES

7.1. LABOR: $7,000

Water Control and Water Quality staff time for preparation of Quality Control Plan, Field Collection of identified samples, and preparation of a Water Quality Sampling Report.

7.2. LABORATORY ANALYSES (MIDWEST LABORATORIES): $4,542

Laboratory Analysis (Midwest Laboratories):

Analyzed Media	Number of Samples	Unit Cost per Sample	Total Cost
Soil	2	$611.20	$1,222.40
Pre-Elutriate	2	$336.80	$673.60
Filtered Elutriate	2	$418.40	$836.80
Non-Filtered Elutriate	2	$540.50	$1,081.00
Receiving Water	1	$727.90	$727.90
TOTAL ANALYSTICAL COSTS			**$4,541.70**

8. REFERENCES

Nebraska Department of Environmental Quality. 2012. Findings of the 2010 Regional Ambient Fish Tissue Program in Nebraska. June 2012. Water Quality Assessment Section, Nebraska Department of Environmental Quality, Lincoln, NE.

USEPA and USACE. 1998. Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Test Manual: Inland Testing Manual. EPA-823-B-98-004, February 1998. U.S. Environmental Protection Agency, Office of Water. Department of Army, U.S. Army Corps of Engineers. Washington, D.C

ATTACHMENT 1. Field Sheet for Indian Cave State Park Elutriate Testing Project.

(U.S. Army Corps of Engineers – Omaha District – Water Quality Unit)

FIELD DATA SHEET

Project Name: Indian Cave State Park Elutriate Monitoring **Project Number:** SPS-INCAVE-002

Trip Number: _____ **Date:** _____

Site Location: Indian Cave State Park SWH Project, Missouri River (RM518)

Site Numbers: IC-W1**,** IC-S1, IC-S2, IC-S3, IC-S4, IC-S5

Collectors: _____

GPS MEASUREMENTS

GPS Device Used: _____

Site IC-S1: Latitude: _____ Longitude: _____

Site IC-S2: Latitude: _____ Longitude: _____

Site IC-S3: Latitude: _____ Longitude: _____

Site IC-S4: Latitude: _____ Longitude: _____

Site IC-S5: Latitude: _____ Longitude: _____

WATER MEASUREMENTS

Water Quality Measurements:

Temp. (°C)	pH (S.U.)	Cond. (umho/cm)	D.O. (mg/L)	D.O. (%Sat)	Turbidity (NTUs)

SAMPLES COLLECTED

Sample Type	Sample ID	Sampled Depth	Collection Time	Sampling Method
Water Sample	IC-W1	Surface		Grab
Sediment/Soil Sample	IC-S1			Composite Core
Sediment/Soil Sample	IC-S2			Near-Surface
Sediment/Soil Sample	IC-S3			Composite Core
Sediment/Soil Sample	IC-S4			Near-Surface
Sediment/Soil Sample	IC-S5			Near-Surface

COMMENTS:

ATTACHMENT 3.

Particle Size Distribution Reports for Sediment/Soil Samples Collected in 2011 at the Proposed Indian Cave State Park Shallow Water Habitat Site

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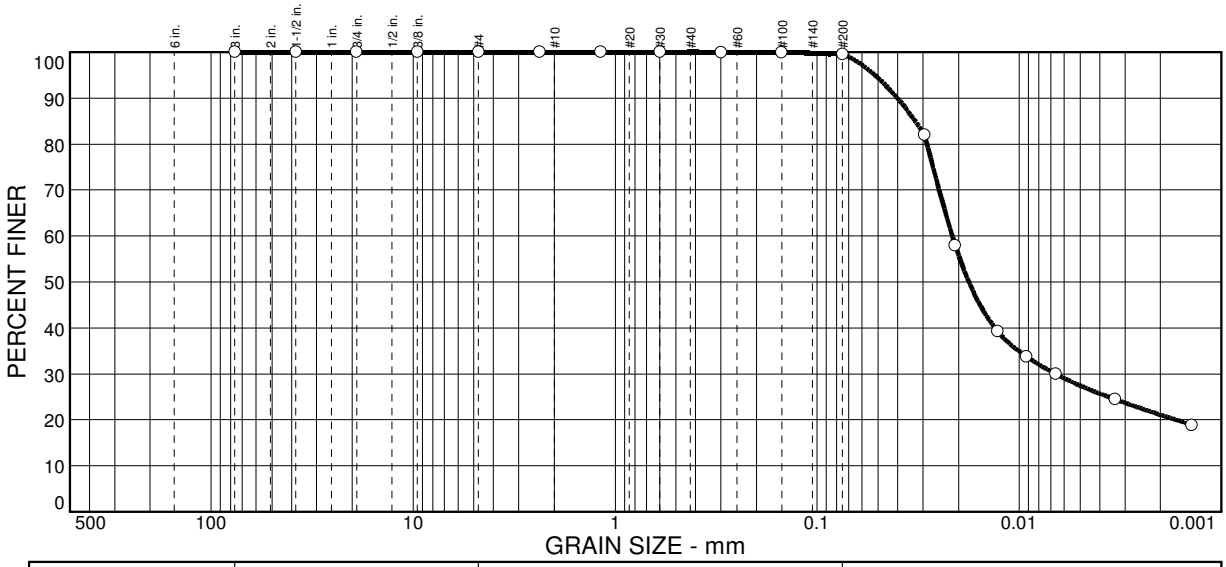
Report Number
11-132-2218

Particle Size Distribution Report

Project: DEER ISLAND ELUTRIATE MONITORING SPS-DEERID-001 EDXDEJ050311 **Report No.:** 11-132-2218
Client: US ARMY CORPS OF ENGINEERS

Sample No: 1844685 **Source of Sample:** **Date:** 05/03/11
Location: IC-S1 **Elev./Depth:**



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.1	0.3	72.1	27.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3 in.	100.0		
1.5 in.	100.0		
.75 in.	100.0		
.375 in.	100.0		
#4	100.0		
#8	100.0		
#16	100.0		
#30	100.0		
#50	99.9		
#100	99.9		
#200	99.6		

* (no specification provided)

Soil Description

Atterberg Limits
PL= LL= PI=

Coefficients
D_{85}= 0.0328 D_{60}= 0.0215 D_{50}= 0.0178
D_{30}= 0.0066 D_{15}= D_{10}=
C_u= C_c=

Classification
USCS= AASHTO=

Remarks

Figure

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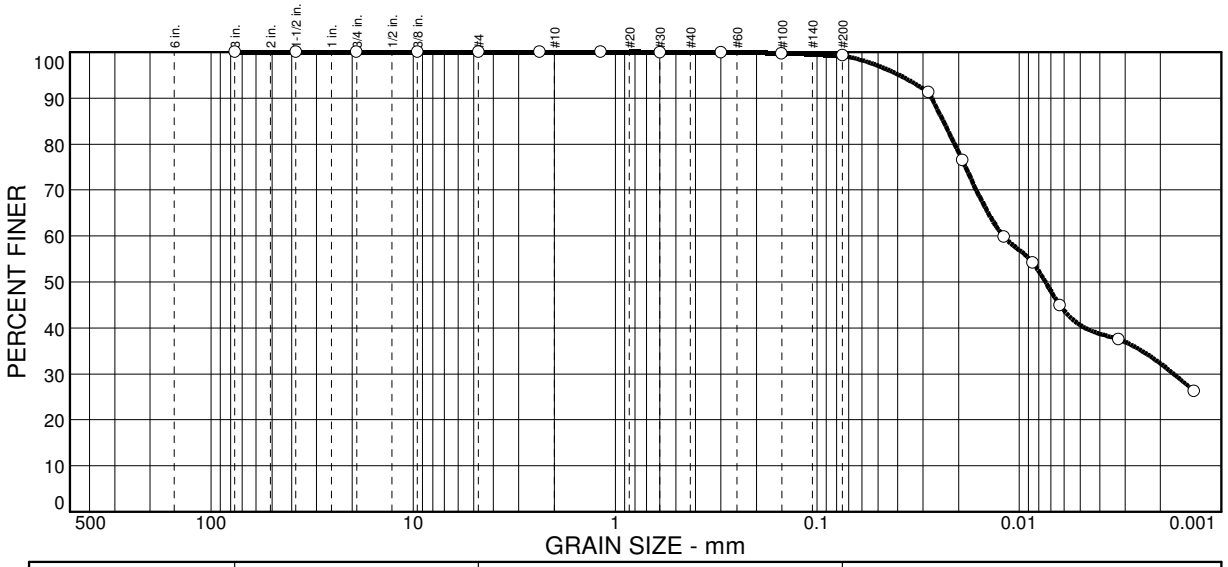
Report Number
11-132-2221

Particle Size Distribution Report

Project: DEER ISLAND ELUTRIATE MONITORING SPS-DEERID-001 EDXDEJ050311 **Report No.:** 11-132-2221
Client: US ARMY CORPS OF ENGINEERS

Sample No: 1844687 **Source of Sample:** **Date:** 05/03/2011
Location: IC-S5 **Elev./Depth:**



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.1	0.6	58.7	40.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3 in.	100.0		
1.5 in.	100.0		
.75 in.	100.0		
.375 in.	100.0		
#4	100.0		
#8	100.0		
#16	100.0		
#30	99.9		
#50	99.9		
#100	99.7		
#200	99.3		

* (no specification provided)

Soil Description

Atterberg Limits
PL= LL= PI=

Coefficients
D_{85}= 0.0238 D_{60}= 0.0120 D_{50}= 0.0074
D_{30}= 0.0017 D_{15}= D_{10}=
C_u= C_c=

Classification
USCS= AASHTO=

Remarks

Figure

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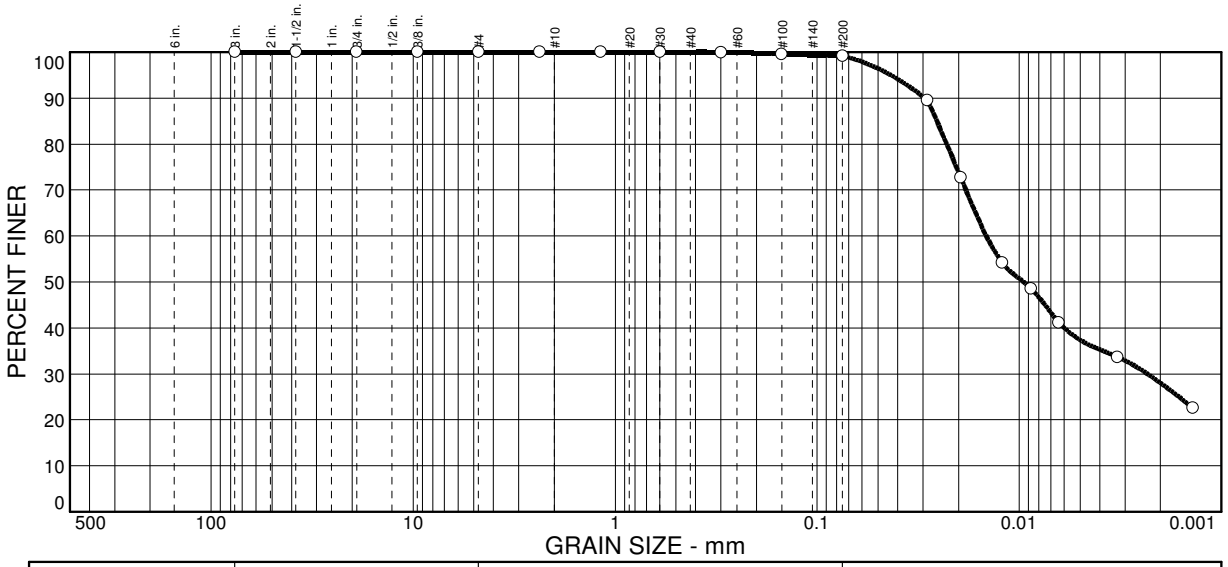
Report Number
11-132-2219

Particle Size Distribution Report

Project: DEER ISLAND ELUTRIATE MONITORING SPS-DEERID-001 EDXDEJ050311 **Report No.:** 11-132-2219
Client: US ARMY CORPS OF ENGINEERS

Sample No: 1844686 **Source of Sample:** **Date:** 05/03/2011
Location: IC-S3 **Elev./Depth:**



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.0	0.8	61.8	37.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3 in.	100.0		
1.5 in.	100.0		
.75 in.	100.0		
.375 in.	100.0		
#4	100.0		
#8	100.0		
#16	100.0		
#30	100.0		
#50	99.9		
#100	99.6		
#200	99.2		

* (no specification provided)

Soil Description

Atterberg Limits
PL= LL= PI=

Coefficients
D_{85}= 0.0256 D_{60}= 0.0146 D_{50}= 0.0095
D_{30}= 0.0023 D_{15}= D_{10}=
C_u= C_c=

Classification
USCS= AASHTO=

Remarks

Figure

ATTACHMENT 4.

Particle Size Distribution Reports for Sediment/Soil Samples Collected in 2013 at the Proposed Indian Cave State Park Shallow Water Habitat Site

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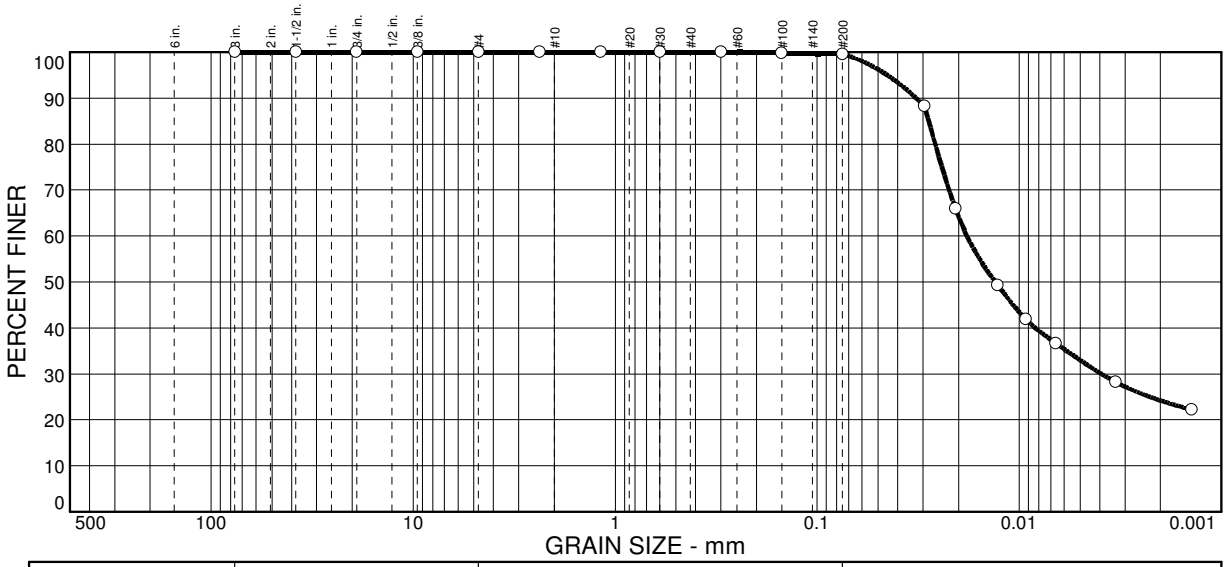
Report Number
13-127-2185

Particle Size Distribution Report

Project: INDIAN CAVE STATE PARK SPS-INCAVE-002 TRIP EDXDEJ042513 **Report No.:** 13-127-2185
Client: US ARMY CORPS OF ENGINEERS

Sample No: 2126545 **Source of Sample:** **Date:** 04/25/13
Location: IC-S1A **Elev./Depth:**



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.0	0.4	66.6	33.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3 in.	100.0		
1.5 in.	100.0		
.75 in.	100.0		
.375 in.	100.0		
#4	100.0		
#8	100.0		
#16	100.0		
#30	100.0		
#50	100.0		
#100	99.8		
#200	99.6		

* (no specification provided)

Soil Description

Atterberg Limits
PL= LL= PI=

Coefficients
D_{85}= 0.0281 D_{60}= 0.0182 D_{50}= 0.0132
D_{30}= 0.0039 D_{15}= D_{10}=
C_u= C_c=

Classification
USCS= AASHTO=

Remarks

Figure

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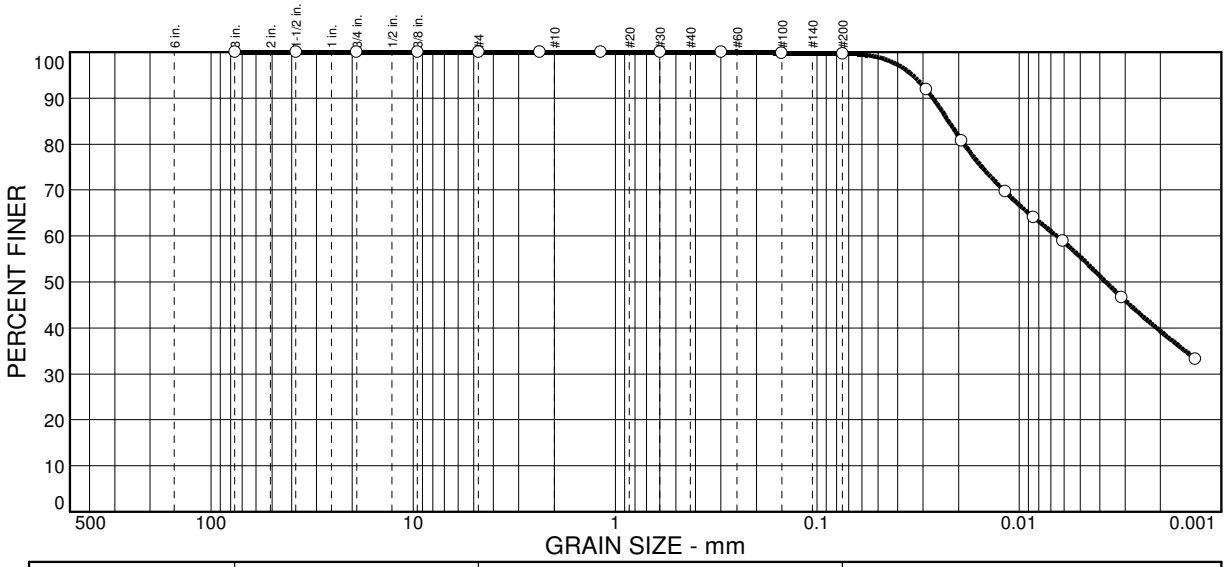
Report Number
13-127-2186

Particle Size Distribution Report

Project: INDIAN CAVE STATE PARK SPS-INCAVE-002 TRIP EDXDEJ042513 **Report No.:** 13-127-2187
Client: US ARMY CORPS OF ENGINEERS

Sample No: 2126546 **Source of Sample:** **Date:** 04/25/13
Location: IC-S1B **Elev./Depth:**



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.0	0.3	44.2	55.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3 in.	100.0		
1.5 in.	100.0		
.75 in.	100.0		
.375 in.	100.0		
#4	100.0		
#8	100.0		
#16	100.0		
#30	100.0		
#50	100.0		
#100	99.8		
#200	99.7		

* (no specification provided)

Soil Description

Atterberg Limits
PL= LL= PI=

Coefficients
D_{85}= 0.0225 D_{60}= 0.0065 D_{50}= 0.0037
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification
USCS= AASHTO=

Remarks

Figure

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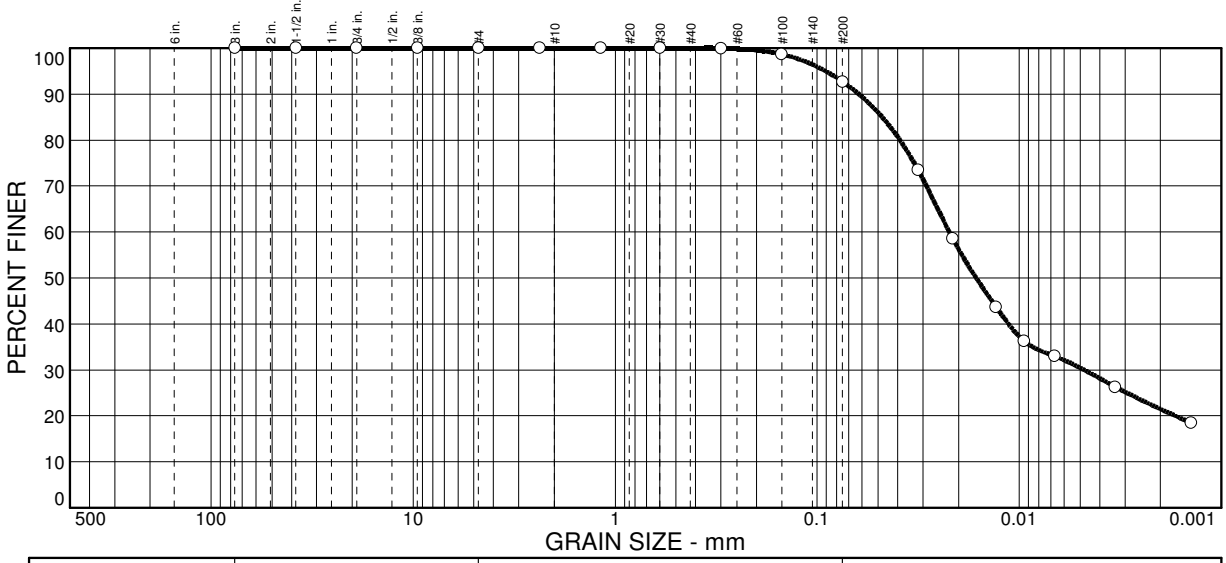
Report Number
13-127-2187

Particle Size Distribution Report

Project: INDIAN CAVE STATE PARK SPS-INCAVE-002 TRIP EDXDEJ042513 **Report No.:** 13-127-2187
Client: US ARMY CORPS OF ENGINEERS

Sample No: 2126547 **Source of Sample:** **Date:** 04/25/13
Location: IC-S3 **Elev./Depth:**



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.0	7.3	62.3	30.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3 in.	100.0		
1.5 in.	100.0		
.75 in.	100.0		
.375 in.	100.0		
#4	100.0		
#8	100.0		
#16	100.0		
#30	100.0		
#50	99.9		
#100	98.7		
#200	92.7		

* (no specification provided)

Soil Description

Atterberg Limits
PL= LL= PI=

Coefficients
D_{85}= 0.0478 D_{60}= 0.0222 D_{50}= 0.0164
D_{30}= 0.0048 D_{15}= D_{10}=
C_u= C_c=

Classification
USCS= AASHTO=

Remarks

Figure

ATTACHMENT 5.

Laboratory Report of 2011 Results for Analysis of Collected Sediment/Soil, Receiving Water, and Prepared Pre-Elutriate and Elutriate Samples at the Proposed Indian Cave State Park Shallow Water Habitat Site

NOTE: Interpretation of Elutriate Results

Under the column Elutriate Water on the Midwest Laboratory analytical results reports are values reported with two asterisks (**) for the following:

Atrazine
Ammonia as N,
Carbonaceous Biochemical Oxygen Demand – CBOD
Kjeldahl Nitrogen – Total
Organochlorine Pesticides
Dieldrin
Polychloinated Biphenyls (PCB's)
Total Organic Carbon – TOC
Total Phosphorus
Total Suspended Solids
Turbidity, Total

These values are for analyses of the "elutriate" supernatant after settling (1-hour) and prior to filtration.

The other reported values under the column Elutriate Water for dissolved metals (i.e., Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, and Zinc) are the results for analyses of the "elutriate" supernatant after settling (1-hour) and filtration.

NOTE: Correction of typographical error.

Project Name and Project # on the reported laboratory results are incorrect. The actual Project Name should be Indian Cave State Park Elutriate Monitoring and the actual Project # should be SPS-INCAVE-001.

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Report #: 11-210-2029
11-180-2020
11-180-2021

USACE
DAVE JENSEN
1616 CAPITOL AVE
OMAHA NE 68102-4901

Project Name: DEER ISLAND ELUTRIATE MONITORING
Project #: SPS-DEERID-001
Trip Number: EDXDEJ050311

Lab Number:						1844688	1844691	1844692
Sample ID:						IC-S1	IC-W1	Elutriate
Parameter	**Method**	**Method Detection Limit**		**Laboratory Reporting Limit**		**Units**	**Soil**	**Receiving Water**	**Elutriate Water**
		soil	**water**	**soil**	**water**				
Atrazine	NEP-GC/MS	1	1	5	3	mg/kg µg/L	n.d.	n.d.	n.d.**
Ammonia as N	EPA 350.2	0.2	0.02	1	0.1	mg/kg µg/L	56.8	0.31	0.03 J**
Arsenic, (dissolved)	EPA 200.8	1	1	5	3	mg/kg µg/L	—	2 J	n.d.
Arsenic, Total	EPA 200.8	1	1	5	3	mg/kg µg/L	1.38	—	—
Cadmium, (dissolved)	EPA 200.8	0.5	0.2	2	1	mg/kg µg/L	—	n.d.	n.d.
Cadmium, Total	EPA 200.8	0.5	0.2	2	1	mg/kg µg/L	1.27	—	—
Carbonaceous Biochemical Oxygen Demand - CBOD	SM 5210.B	-	2	-	5	mg/L	—	2J	n.d.**
Chemical Oxygen Demand-COD	ASTM 1252	-	3	-	10	mg/L	—	21	17
Chromium, (dissolved)	EPA 200.7	0.2	1	1	10	mg/kg µg/L	—	n.d.	n.d.
Chromium, Total	EPA 200.7	0.2	1	1	10	mg/kg µg/L	16.8	—	—
Copper, (dissolved)	EPA 200.7	0.2	1	1.0	5	mg/kg µg/L	—	4 J	n.d.
Copper, Total	EPA 200.7	0.2	1	1.0	5	mg/kg µg/L	14.3	—	—
Kjeldahl Nitrogen - Total	EPA 351.3	2	0.2	10	0.5	mg/kg mg/L	809	0.89	0.95**
Lead, dissolved	EPA 200.7	1	0.5	5	2	mg/kg µg/L	—	n.d.	n.d.
Lead, Total	EPA 200.7	1	0.5	5	2	mg/kg µg/L	10.3	—	—
Mercury, (dissolved)	EPA 245.1	0.2	0.08	1	0.04	mg/kg µg/L	—	n.d.	n.d.
Mercury, Total	EPA 245.1	0.2	0.08	1	0.04	mg/kg µg/L	n.d.	—	—
Nickel, (dissolved)	EPA 200.7	0.2	10	2	30	mg/kg µg/L	—	n.d.	n.d.
Nickel, Total	EPA 200.7	0.2	10	2	30	mg/kg µg/L	14.1	—	—
Nitrate/Nitrite Nitrogen	EPA 353.2	0.2	0.02	1	0.10	mg/kg mg/L	2.8	0.7	1.8
Organochlorine Pesticides	EPA 8081			*	*	—	n.d.*Page 2	n.d.*Page 3&5	n.d.*Page 4&6**
pH	SM 4500-H	0.1		0.2		—	7.7	8.33	7.9
Dieldrin	EPA 8081			*	*	—	n.d.*Page 2	n.d.*Page 3&5	n.d.*Page 4&6**
Phosphorus (dissolved ortho)	SM 4500 P-G			*	*	mg/kg mg/L	—	0.06	0.04 J
Phosphorus (dissolved total)	SM 4500 P-H			*	*	mg/kg mg/L	—	0.07	0.05
Polychlorinated Biphenyls (PCB's)	EPA 8082			*	*	—	n.d.*Page 2	n.d.*Page 3&5	n.d.*Page 4&6**
Total Organic Carbon - TOC	EPA 415.1	2	0.2	10.0	1	mg/kg mg/L	8,000	6.8	8.3**
Total Phosphorus	SM 4500 P-F	0.2	0.02	1	0.05	mg/kg mg/L	496	0.24	0.24**
Total Suspended Solids	SM 2540D	-	4	-	10	mg/L	—	184	119**
Turbidity, Total	EPA 180.1	-	1	-	3	NTU	—	60	178**
Zinc, (dissolved)	EPA 200.7	1	10	5	30	mg/kg µg/L	—	n.d.	10 J
Zinc Total	EPA 200.7	1	10	5	30	mg/kg µg/L	57.5	—	—

n.d. = Not Detected
— Test not requested/Applicable
J = Estimated concentration below laboratory reporting limit.
* See attached report
** Analysis determined on the Elutriate Supernat prior to filteration.
PCB's - Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260

Prem N. Arora

Prem N. Arora, Environmental Project Manager
Midwest Laboratories, Inc.

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REPORT OF ANALYSIS

Report Number: 11-210-2029

Reported to:
US ARMY CORPS OF
ENGINEERS
DAVE JENSEN
CENWO-ED-HA
1616 CAPITOL AVE 5TH FLOOR
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEERS
(402)995-2310

Date Reported: 07/29/11
Date Received: 05/03/11
Date Sampled: 05/03/11

PO/Proj. #: SPS-GVPTBD-001
SPS-DEERID-001
DEER ISLAND ELUTRIATE
MONITORING EDXDEJ050311

Lab number: 1844688 **Sample ID:** IC-S1 SOIL

Method: EPA 8080/8082 **Units:** mg/Kg **Analyst:** spa **Date of Analysis:** 5/16/2010

Analysis	Level Found	Method Detection Limit	Reporting Limit (µg/L)	Analysis	Level Found	Method Detection Limit	Reporting Limit (µg/L)
4,4'-DDE	n.d.	0.0003	9.9	Endosulfan I	n.d.	0.001	5.1
4,4'-DDD	n.d.	0.0004	9.9	Endosulfan II	n.d.	0.001	9.9
4,4'-DDT	n.d.	0.0003	9.9	Endosulfan sulfate	n.d.	0.001	9.9
4,4'-Methoxychlor	n.d.	0.001	51	Endrin	n.d.	0.001	9.9
Aldrin	n.d.	0.001	5.1	Endrin aldehyde	n.d.	0.001	9.9
Aroclor 1016	n.d.	0.008	50	Endrin ketone	n.d.	0.001	9.9
Aroclor 1221	n.d.	0.01	50	Heptachlor	n.d.	0.001	5.1
Aroclor 1232	n.d.	0.009	50	Heptachlor epoxide	n.d.	0.001	5.1
Aroclor 1242	n.d.	0.01	50	alpha-Chlordane	n.d.	0.004	5.1
Aroclor 1248	n.d.	0.008	50	alpha-BHC	n.d.	0.001	5.1
Aroclor 1254	n.d.	0.01	50	beta- BHC	n.d.	0.001	5.1
Aroclor 1260	n.d.	0.01	50	delta-BHC	n.d.	0.001	5.1
Dieldrin	n.d.	0.000	9.9	gama-BHC (Lindane)	n.d.	0.001	5.1

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REPORT OF ANALYSIS

Report Number: 11-180-2020

Reported to:
US ARMY CORPS OF
ENGINEERS
DAVE JENSEN
CENWO-ED-HA
1616 CAPITOL AVE 5TH FLOOR
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEER
(402) 995-2310

PO/Proj. SPS-DEERID-001
DEER ISLAND ELUTRIATE
MONITORING EDXDEJ050311

Date Reported: 07/29/11
Date Received: 05/03/11
Date Sampled 05/03/11

Lab number: 1844691 **Sample ID:** IC-W1 MISSOURI RIVER OVERBURDEN WATER

Method: EPA 8081A/8082 **Units:** µg/L **Analyst:** awr **Date of Analysis:** 5/10/2011

Analysis	Level Found	Method Detection Limit	Reporting Limit	Analysis	Level Found	Method Detection Limit	Reporting Limit
4,4'-DDE	n.d.	0.003	0.10	Endosulfan I	n.d.	0.005	0.05
4,4'-DDD	n.d.	0.004	0.10	Endosulfan II	n.d.	0.003	0.1
4,4'-DDT	n.d.	0.009	0.10	Endosulfan sulfate	n.d.	0.002	0.1
4,4'-Methoxychlor	n.d.	0.01	0.50	Endrin	n.d.	0.004	0.1
Aldrin	n.d.	0.004	0.50	Endrin aldehyde	n.d.	0.004	0.1
Aroclor 1016	n.d.	0.08	0.01	Heptachlor	n.d.	0.006	0.05
Aroclor 1221	n.d.	0.1	0.01	Heptachlor epoxide	n.d.	0.005	0.05
Aroclor 1232	n.d.	0.1	0.01	alpha-Chlordane	n.d.	0.04	0.05
Aroclor 1242	n.d.	0.1	0.01	alpha-BHC	n.d.	0.001	0.05
Aroclor 1248	n.d.	0.08	0.01	beta- BHC	n.d.	0.005	0.05
Aroclor 1254	n.d.	0.05	0.01	delta-BHC	n.d.	0.005	0.05
Aroclor 1260	n.d.	0.1	0.01	gama-BHC (Lindane)	n.d.	0.001	0.05
Dieldrin	n.d.	0.001	0.01				

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REPORT OF ANALYSIS

Report Number: 11-180-2021

Reported to: US ARMY CORPS OF ENGINEERS
DAVE JENSEN
CENWO-ED-HA
1616 CAPITOL AVE 5TH FLOOR
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEER
(402) 995-2310

PO/Proj. SPS-DEERID-001
DEER ISLAND ELUTRIATE
MONITORING EDXDEJ050311

Date Reported: 07/29/11
Date Received: 05/03/11
Date Sampled 05/03/11

Lab number: 1844692 **Sample ID:** ELUTRIATE IC-S1 / IC-W1

Method: EPA 8081A/8082 **Units:** µg/L **Analyst:** spa **Date of Analysis:** 5/10/2011

Analysis	Level Found	Method Detection Limit	Reporting Limit	Analysis	Level Found	Method Detection Limit	Reporting Limit
4,4'-DDE	n.d.	0.003	0.10	Endosulfan I	n.d.	0.005	0.05
4,4'-DDD	n.d.	0.004	0.10	Endosulfan II	n.d.	0.003	0.1
4,4'-DDT	n.d.	0.009	0.10	Endosulfan sulfate	n.d.	0.002	0.1
4,4'-Methoxychlor	n.d.	0.01	0.50	Endrin	n.d.	0.004	0.1
Aldrin	n.d.	0.004	0.50	Endrin aldehyde	n.d.	0.004	0.1
Aroclor 1016	n.d.	0.08	0.01	Heptachlor	n.d.	0.006	0.05
Aroclor 1221	n.d.	0.1	0.01	Heptachlor epoxide	n.d.	0.005	0.05
Aroclor 1232	n.d.	0.1	0.01	alpha-Chlordane	n.d.	0.04	0.05
Aroclor 1242	n.d.	0.1	0.01	alpha-BHC	n.d.	0.001	0.05
Aroclor 1248	n.d.	0.08	0.01	beta- BHC	n.d.	0.005	0.05
Aroclor 1254	n.d.	0.05	0.01	delta-BHC	n.d.	0.005	0.05
Aroclor 1260	n.d.	0.1	0.01	gama-BHC (Lindane)	n.d.	0.001	0.05
Dieldrin	n.d.	0.002	0.01				

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REPORT OF ANALYSIS

Report Number: 11-180-2020

Reported to:
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CENWO-ED-HA
1616 CAPITOL AVE 5TH FLOOR
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEER
(402) 995-2310

PO/Proj. SPS-DEERID-001
DEER ISLAND ELUTRIATE
MONITORING EDXDEJ050311

Date Reported: 07/29/11
Date Received: 05/03/11
Date Sampled 05/03/11

LOW LEVEL ANALYSIS

Lab number: 1844691 **Sample ID:** IC-W1 MISSOURI RIVER OVERBURDEN WATER

Method: EPA 8081A/8082 **Units:** µg/L **Date of Analysis:** 5/10/2011

Analysis	Level Found	Method Detection Limit	Reporting Limit
Aroclor 1016	n.d.	0.0002	0.0009
Aroclor 1221	n.d.	0.0003	0.0009
Aroclor 1232	n.d.	0.0003	0.0009
Aroclor 1242	n.d.	0.0003	0.0009
Aroclor 1248	n.d.	0.0003	0.0009
Aroclor 1254	n.d.	0.0003	0.0009
Aroclor 1260	n.d.	0.0003	0.0009
Dieldrin	n.d.	0.0002	0.0009

* This Low level analysis was done by Corps of Engineers lab (USACE-ERDC-EPC) in Vicksburg MS.

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REPORT OF ANALYSIS

Report Number: 11-180-2021

Reported to:
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OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEER
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PO/Proj. SPS-DEERID-001
DEER ISLAND ELUTRIATE
MONITORING EDXDEJ050311

Date Reported: 07/29/11
Date Received: 05/03/11
Date Sampled 05/03/11

LOW LEVEL ANALYSIS

Lab number: 1844692 **Sample ID:** ELUTRIATE IC-S1-IC-W1

Method: EPA 8081A/8082 **Units:** µg/L **Date of Analysis:** 5/10/2011

Analysis	Level Found	Method Detection Limit	Reporting Limit
Aroclor 1016	n.d.	0.0002	0.0009
Aroclor 1221	n.d.	0.0003	0.0009
Aroclor 1232	n.d.	0.0003	0.0009
Aroclor 1242	n.d.	0.0003	0.0009
Aroclor 1248	n.d.	0.0003	0.0009
Aroclor 1254	n.d.	0.0003	0.0009
Aroclor 1260	n.d.	0.0003	0.0009
Dieldrin	n.d.	0.0002	0.0009

* This Low level analysis was done by Corps of Engineers lab (USACE-ERDC-EPC) in Vicksburg MS.

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Report #: 11-210-2030
11-180-2020
11-180-2022

USACE
DAVE JENSEN
1616 CAPITOL AVE
OMAHA NE 68102-4901

Project Name: DEER ISLAND ELUTRIATE MONITORING
Project #: SPS-DEERID-001
Trip Number: EDXDEJ050311

Lab Number:						1844689	1844691	1844693
Sample ID:						IC-S3	IC-W1	Elutriate
Parameter	**Method**	**Method Detection Limit**		**Laboratory Reporting Limit**		**Units**	**Soil**	**Receiving Water**	**Elutriate Water**
		soil	**water**	**soil**	**water**				
Atrazine	NEP-GC/MS	1	1	5	3	mg/kg µg/L	n.d.	n.d.	n.d.**
Ammonia as N	EPA 350.2	0.2	0.02	1	0.1	mg/kg µg/L	61	0.31	0.08 J**
Arsenic, (dissolved)	EPA 200.8	1	1	5	3	mg/kg µg/L	—	2 J	n.d.
Arsenic, Total	EPA 200.8	1	1	5	3	mg/kg µg/L	n.d.	—	—
Cadmium, (dissolved)	EPA 200.8	0.5	0.2	2	1	mg/kg µg/L	—	n.d.	n.d.
Cadmium, Total	EPA 200.8	0.5	0.2	2	1	mg/kg µg/L	1.38	—	—
Carbonaceous Biochemical Oxygen Demand - CBOD	SM 5210.B	-	2	-	5	mg/L	—	2 J	n.d.**
Chemical Oxygen Demand-COD	ASTM 1252	-	3	-	10	mg/L	—	21	18
Chromium, (dissolved)	EPA 200.7	0.2	1	1	10	mg/kg µg/L	—	n.d.	3 J
Chromium, Total	EPA 200.7	0.2	1	1	10	mg/kg µg/L	17.5	—	—
Copper, (dissolved)	EPA 200.7	0.2	1	1.0	5	mg/kg µg/L	—	4 J	n.d.
Copper, Total	EPA 200.7	0.2	1	1.0	5	mg/kg µg/L	18.3	—	—
Kjeldahl Nitrogen - Total	EPA 351.3	2	0.2	10	0.5	mg/kg mg/L	763	0.89	0.99**
Lead, dissolved	EPA 200.7	1	0.5	5	2	mg/kg µg/L	—	n.d.	n.d.
Lead, Total	EPA 200.7	1	0.5	5	2	mg/kg µg/L	12.4	—	—
Mercury, (dissolved)	EPA 245.1	0.2	0.08	1	0.04	mg/kg µg/L	—	n.d.	n.d.
Mercury, Total	EPA 245.1	0.2	0.08	1	0.04	mg/kg µg/L	n.d.	—	—
Nickel, (dissolved)	EPA 200.7	0.2	10	2	30	mg/kg µg/L	—	n.d.	n.d.
Nickel, Total	EPA 200.7	0.2	10	2	30	mg/kg µg/L	20.1	—	—
Nitrate/Nitrite Nitrogen	EPA 353.2	0.2	0.02	1	0.10	mg/kg mg/L	1.9	0.7	1.6
Organochlorine Pesticides	EPA 8081			*	*	—	n.d.*Page 2	n.d.*Page 3&5	n.d.*Page 4&6**
pH	SM 4500-H	0.1		0.2		—	7.5	8.33	7.87
Dieldrin	EPA 8081			*	*	—	n.d.*Page 2	n.d.*Page 3&5	n.d.*Page 4&6**
Phosphorus (dissolved ortho)	SM 4500 P-G			*	*	mg/kg mg/L	—	0.06	n.d.
Phosphorus (dissolved total)	SM 4500 P-H			*	*	mg/kg mg/L	—	0.07	0.06
Polychlorinated Biphenyls (PCB's)	EPA 8082			*	*	—	n.d.*Page 2	n.d.*Page 3&5	n.d.*Page 4&6**
Total Organic Carbon - TOC	EPA 415.1	2	0.2	10.0	1	mg/kg mg/L	10,500	6.8	7.8**
Total Phosphorus	SM 4500 P-F	0.2	0.02	1	0.05	mg/kg mg/L	343	0.24	0.25**
Total Suspended Solids	SM 2540D	-	4	-	10	mg/L	—	184	116**
Turbidity, Total	EPA 180.1	-	1	-	3	NTU	—	60	206**
Zinc, (dissolved)	EPA 200.7	1	10	5	30	mg/kg µg/L	—	n.d.	10
Zinc Total	EPA 200.7	1	10	5	30	mg/kg µg/L	64.3	—	—

n.d. = Not Detected
— Test not requested/Applicable
J = Estimated concentration below laboratory reporting limit.
* See attached report
** Analysis determined on the Elutriate Supernat prior to filteration.
PCB's - Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260

Prem N. Arora

Prem N. Arora, Environmental Project Manager
Midwest Laboratories, Inc.

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REPORT OF ANALYSIS

Report Number: 11-210-2030

Reported to:
US ARMY CORPS OF
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DAVE JENSEN
CENWO-ED-HA
1616 CAPITOL AVE 5TH FLOOR
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEEI
(402) 995-2310

Date Reported: 07/29/11
Date Received: 05/03/11
Date Sampled 05/03/11

PO/Prc DEER ISLAND ELUTRIATE MONITORING
SPS-DEERID-001
EDXDEJ050311

Lab number: 1844689 **Sample ID:** IC-S3 SOIL

Method: EPA 8080/8082 **Units:** mg/Kg **Analyst:** awr **Date of Analysis:** 5/16/2011

Analysis	Level Found	Method Detection Limit	Reporting Limit	Analysis	Level Found	Method Detection Limit	Reporting Limit
4,4'-DDE	n.d.	0.0003	9.9	Endosulfan I	n.d.	0.002	5.1
4,4'-DDD	n.d.	0.0005	9.9	Endosulfan II	n.d.	0.0008	9.9
4,4'-DDT	n.d.	0.0003	9.9	Endosulfan sulfate	n.d.	0.0008	9.9
4,4'-Methoxychlor	n.d.	0.002	51	Endrin	n.d.	0.002	9.9
Aldrin	n.d.	0.001	5.1	Endrin aldehyde	n.d.	0.0008	9.9
Aroclor 1016	n.d.	0.009	50	Heptachlor	n.d.	0.002	5.1
Aroclor 1221	n.d.	NA	50	Heptachlor epoxide	n.d.	0.0008	5.1
Aroclor 1232	n.d.	NA	50	alpha-Chlordane	n.d.	0.005	5.1
Aroclor 1242	n.d.	0.02	50	alpha-BHC	n.d.	0.0008	5.1
Aroclor 1248	n.d.	0.009	50	beta- BHC	n.d.	0.002	5.1
Aroclor 1254	n.d.	0.02	50	delta-BHC	n.d.	0.0008	5.1
Aroclor 1260	n.d.	0.02	50	gama-BHC (Lindane)	n.d.	0.0008	5.1
Dieldrin	n.d.	0.0003	9.9				

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REPORT OF ANALYSIS

Report Number: 11-180-2020

Reported to:
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CENWO-ED-HA
1616 CAPITOL AVE 5TH FLOOR
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEER
(402) 995-2310

PO/Proj. SPS-DEERID-001
DEER ISLAND ELUTRIATE
MONITORING EDXDEJ050311

Date Reported: 07/29/11
Date Received: 05/03/11
Date Sampled 05/03/11

Lab number: 1844691 **Sample ID:** IC-W1 MISSOURI RIVER OVERBURDEN WATER

Method: EPA 8081A/8082 **Units:** µg/L **Analyst:** awr **Date of Analysis:** 5/10/2011

Analysis	Level Found	Method Detection Limit	Reporting Limit	Analysis	Level Found	Method Detection Limit	Reporting Limit
4,4'-DDE	n.d.	0.003	0.10	Endosulfan I	n.d.	0.005	0.05
4,4'-DDD	n.d.	0.004	0.10	Endosulfan II	n.d.	0.003	0.1
4,4'-DDT	n.d.	0.009	0.10	Endosulfan sulfate	n.d.	0.002	0.1
4,4'-Methoxychlor	n.d.	0.01	0.50	Endrin	n.d.	0.004	0.1
Aldrin	n.d.	0.004	0.50	Endrin aldehyde	n.d.	0.004	0.1
Aroclor 1016	n.d.	0.08	0.01	Heptachlor	n.d.	0.006	0.05
Aroclor 1221	n.d.	0.1	0.01	Heptachlor epoxide	n.d.	0.005	0.05
Aroclor 1232	n.d.	0.1	0.01	alpha-Chlordane	n.d.	0.04	0.05
Aroclor 1242	n.d.	0.1	0.01	alpha-BHC	n.d.	0.001	0.05
Aroclor 1248	n.d.	0.08	0.01	beta- BHC	n.d.	0.005	0.05
Aroclor 1254	n.d.	0.05	0.01	delta-BHC	n.d.	0.005	0.05
Aroclor 1260	n.d.	0.1	0.01	gama-BHC (Lindane)	n.d.	0.001	0.05
Dieldrin	n.d.	0.001	0.01				

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REPORT OF ANALYSIS

Report Number: 11-180-2022

Reported to:
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DAVE JENSEN
CENWO-ED-HA
1616 CAPITOL AVE 5TH FLOOR
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEER
(402) 995-2310

PO/Proj. SPS-DEERID-001
DEER ISLAND ELUTRIATE
MONITORING EDXDEJ050311

Date Reported: 07/29/11
Date Received: 05/03/11
Date Sampled 05/03/11

Lab number: 1844693 **Sample ID:** ELUTRIATE IC-S3 / IC-W1

Method: EPA 8081A/8082 **Units:** µg/L **Analyst:** spa **Date of Analysis:** 5/10/2011

Analysis	Level Found	Method Detection Limit	Reporting Limit	Analysis	Level Found	Method Detection Limit	Reporting Limit
4,4'-DDE	n.d.	0.003	0.10	Endosulfan I	n.d.	0.005	0.05
4,4'-DDD	n.d.	0.004	0.10	Endosulfan II	n.d.	0.003	0.1
4,4'-DDT	n.d.	0.009	0.10	Endosulfan sulfate	n.d.	0.002	0.1
4,4'-Methoxychlor	n.d.	0.01	0.50	Endrin	n.d.	0.004	0.1
Aldrin	n.d.	0.005	0.50	Endrin aldehyde	n.d.	0.004	0.1
Aroclor 1016	n.d.	0.08	0.01	Heptachlor	n.d.	0.006	0.05
Aroclor 1221	n.d.	0.1	0.01	Heptachlor epoxide	n.d.	0.005	0.05
Aroclor 1232	n.d.	0.1	0.01	alpha-Chlordane	n.d.	0.04	0.05
Aroclor 1242	n.d.	0.1	0.01	alpha-BHC	n.d.	0.001	0.05
Aroclor 1248	n.d.	0.08	0.01	beta- BHC	n.d.	0.005	0.05
Aroclor 1254	n.d.	0.05	0.01	delta-BHC	n.d.	0.005	0.05
Aroclor 1260	n.d.	0.1	0.01	gama-BHC (Lindane)	n.d.	0.001	0.05
Dieldrin	n.d.	0.002	0.01				

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REPORT OF ANALYSIS

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For: (20061) US ARMY CORPS OF ENGINEER
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DEER ISLAND ELUTRIATE
MONITORING EDXDEJ050311

Date Reported: 07/29/11
Date Received: 05/03/11
Date Sampled 05/03/11

LOW LEVEL ANALYSIS

Lab number: 1844691 **Sample ID:** IC-W1 MISSOURI RIVER OVERBURDEN WATER

Method: EPA 8081A/8082 **Units:** µg/L **Date of Analysis:** 5/10/2011

Analysis	Level Found	Method Detection Limit	Reporting Limit
Aroclor 1016	n.d.	0.0002	0.0009
Aroclor 1221	n.d.	0.0003	0.0009
Aroclor 1232	n.d.	0.0003	0.0009
Aroclor 1242	n.d.	0.0003	0.0009
Aroclor 1248	n.d.	0.0003	0.0009
Aroclor 1254	n.d.	0.0003	0.0009
Aroclor 1260	n.d.	0.0003	0.0009
Dieldrin	n.d.	0.0002	0.0009

* This Low level analysis was done by Corps of Engineers lab (USACE-ERDC-EPC) in Vicksburg MS.

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REPORT OF ANALYSIS

Report Number: 11-180-2022

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PO/Proj. SPS-DEERID-001
DEER ISLAND ELUTRIATE
MONITORING EDXDEJ050311

Date Reported: 07/29/11
Date Received: 05/03/11
Date Sampled 05/03/11

LOW LEVEL ANALYSIS

Lab number: 1844693 **Sample ID:** ELUTRIATE IC-S3/CI-WI

Method: EPA 8081A/8082 **Units:** µg/L **Date of Analysis:** 5/10/2011

Analysis	Level Found	Method Detection Limit	Reporting Limit
Aroclor 1016	n.d.	0.0002	0.0009
Aroclor 1221	n.d.	0.0003	0.0009
Aroclor 1232	n.d.	0.0003	0.0009
Aroclor 1242	n.d.	0.0003	0.0009
Aroclor 1248	n.d.	0.0003	0.0009
Aroclor 1254	n.d.	0.0003	0.0009
Aroclor 1260	n.d.	0.0003	0.0009
Dieldrin	n.d.	0.0002	0.0009

* This Low level analysis was done by Corps of Engineers lab (USACE-ERDC-EPC) in Vicksburg MS.

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Report #: 11-210-2031
11-180-2020
11-180-2023

USACE
DAVE JENSEN
1616 CAPITOL AVE
OMAHA NE 68102-4901

Project Name: DEER ISLAND ELUTRIATE MONITORING
Project #: SPS-DEERID-001
Trip Number: EDXDEJ050311

Lab Number:						1844690	1844691	1844694
Sample ID:						IC-S5	IC-W1	Elutriate
Parameter	Method	Method Detection Limit		Laboratory Reporting Limit		Units	Soil	Receiving Water	Elutriate Water
		soil	water	soil	water				
Atrazine	NEP-GC/MS	1	1	5	3	mg/kg µg/L	n.d.	n.d.	n.d.**
Ammonia as N	EPA 350.2	0.2	0.02	1	0.1	mg/kg µg/L	108	0.31	0.02 J**
Arsenic, (dissolved)	EPA 200.8	1	1	5	3	mg/kg µg/L	—	2 J	n.d.
Arsenic, Total	EPA 200.8	1	1	5	3	mg/kg µg/L	n.d.	—	—
Cadmium, (dissolved)	EPA 200.8	0.5	0.2	2	1	mg/kg µg/L	—	n.d.	n.d.
Cadmium, Total	EPA 200.8	0.5	0.2	2	1	mg/kg µg/L	1.84	—	—
Carbonaceous Biochemical Oxygen Demand - CBOD	SM 5210.B	-	2	-	5	mg/L	—	2 J	2 J**
Chemical Oxygen Demand-COD	ASTM 1252	-	3	-	10	mg/L	—	21	20
Chromium, (dissolved)	EPA 200.7	0.2	1	1	10	mg/kg µg/L	—	n.d.	n.d.
Chromium, Total	EPA 200.7	0.2	1	1	10	mg/kg µg/L	21.6	—	—
Copper, (dissolved)	EPA 200.7	0.2	1	1.0	5	mg/kg µg/L	—	4 J	n.d.
Copper, Total	EPA 200.7	0.2	1	1.0	5	mg/kg µg/L	22.4	—	—
Kjeldahl Nitrogen - Total	EPA 351.3	2	0.2	10	0.5	mg/kg mg/L	1385	0.89	1.23**
Lead, dissolved	EPA 200.7	1	0.5	5	2	mg/kg µg/L	—	n.d.	n.d.
Lead, Total	EPA 200.7	1	0.5	5	2	mg/kg µg/L	16.0	—	—
Mercury, (dissolved)	EPA 245.1	0.2	0.08	1	0.04	mg/kg µg/L	—	n.d.	n.d.
Mercury, Total	EPA 245.1	0.2	0.08	1	0.04	mg/kg µg/L	n.d.	—	—
Nickel, (dissolved)	EPA 200.7	0.2	10	2	30	mg/kg µg/L	—	n.d.	n.d.
Nickel, Total	EPA 200.7	0.2	10	2	30	mg/kg µg/L	25.1	—	—
Nitrate/Nitrite Nitrogen	EPA 353.2	0.2	0.02	1	0.10	mg/kg mg/L	1.1	0.7	1.5
Organochlorine Pesticides	EPA 8081			*	*	—	n.d.*Page 2	n.d.*Page 3&5	n.d.*Page 4&6**
pH	SM 4500-H	0.1		0.2		—	7.7	8.33	7.81
Dieldrin	EPA 8081			*	*	—	n.d.*Page 2	n.d.*Page 3&5	n.d.*Page 4&6**
Phosphorus (dissolved ortho)	SM 4500 P-G			*	*	mg/kg mg/L	—	0.06	0.11
Phosphorus (dissolved total)	SM 4500 P-H			*	*	mg/kg mg/L	—	0.07	0.28
Polychlorinated Biphenyls (PCB's)	EPA 8082			*	*	—	n.d.*Page 2	n.d.*Page 3&5	n.d.*Page 4&6**
Total Organic Carbon - TOC	EPA 415.1	2	0.2	10.0	1	mg/kg mg/L	12,200	6.8	7.4**
Total Phosphorus	SM 4500 P-F	0.2	0.02	1	0.05	mg/kg mg/L	262	0.24	0.28**
Total Suspended Solids	SM 2540D	-	4	-	10	mg/L	—	184	79**
Turbidity, Total	EPA 180.1	-	1	-	3	NTU	—	60	201**
Zinc, (dissolved)	EPA 200.7	1	10	5	30	mg/kg µg/L	—	n.d.	n.d.
Zinc Total	EPA 200.7	1	10	5	30	mg/kg µg/L	80.7	—	—

n.d. = Not Detected
— Test not requested/Applicable
J = Estimated concentration below laboratory reporting limit.
* See attached report
** Analysis determined on the Elutriate Supernat prior to filteration.
PCB's - Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260

Prem N. Arora

Prem N. Arora, Environmental Project Manager
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REPORT OF ANALYSIS

Report Number: 11-210-2031

Reported to:
US ARMY CORPS OF
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DAVE JENSEN
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1616 CAPITOL AVE 5TH FLOOR
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEERS
(402)995-2310

PO/Proj. #: SPS-GVPTBD-001
SPS-DEERID-001
DEER ISLAND ELUTRIATE
MONITORING EDXDEJ050311

Date Reported: 07/29/11
Date Received: 05/03/11
Date Sampled: 05/03/11

Lab number: 1844690 **Sample ID:** IC-S5 SOIL

Method: EPA 8080/8082 **Units:** mg/Kg **Analyst:** spa **Date of Analysis:** 5/16/2010

Analysis	Level Found	Method Detection Limit	Reporting Limit (µg/L)	Analysis	Level Found	Method Detection Limit	Reporting Limit (µg/L)
4,4'-DDE	n.d.	0.0003	9.9	Endosulfan I	n.d.	0.001	5.1
4,4'-DDD	n.d.	0.0004	9.9	Endosulfan II	n.d.	0.001	9.9
4,4'-DDT	n.d.	0.0003	9.9	Endosulfan sulfate	n.d.	0.001	9.9
4,4'-Methoxychlor	n.d.	0.001	51	Endrin	n.d.	0.001	9.9
Aldrin	n.d.	0.001	5.1	Endrin aldehyde	n.d.	0.001	9.9
Aroclor 1016	n.d.	0.008	50	Endrin ketone	n.d.	0.001	9.9
Aroclor 1221	n.d.	0.01	50	Heptachlor	n.d.	0.001	5.1
Aroclor 1232	n.d.	0.010	50	Heptachlor epoxide	n.d.	0.001	5.1
Aroclor 1242	n.d.	0.01	50	alpha-Chlordane	n.d.	0.004	5.1
Aroclor 1248	n.d.	0.008	50	alpha-BHC	n.d.	0.001	5.1
Aroclor 1254	n.d.	0.01	50	beta- BHC	n.d.	0.001	5.1
Aroclor 1260	n.d.	0.01	50	delta-BHC	n.d.	0.001	5.1
Dieldrin	n.d.	0.0003	9.9	gama-BHC (Lindane)	n.d.	0.001	5.1

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REPORT OF ANALYSIS

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PO/Proj. SPS-DEERID-001
DEER ISLAND ELUTRIATE
MONITORING EDXDEJ050311

Date Reported: 07/29/11
Date Received: 05/03/11
Date Sampled 05/03/11

Lab number: 1844691 **Sample ID:** IC-W1 MISSOURI RIVER OVERBURDEN WATER

Method: EPA 8081A/8082 **Units:** µg/L **Analyst:** spa **Date of Analysis:** 5/10/2011

Analysis	Level Found	Method Detection Limit	Reporting Limit	Analysis	Level Found	Method Detection Limit	Reporting Limit
4,4'-DDE	n.d.	0.003	0.10	Endosulfan I	n.d.	0.005	0.05
4,4'-DDD	n.d.	0.004	0.10	Endosulfan II	n.d.	0.003	0.1
4,4'-DDT	n.d.	0.009	0.10	Endosulfan sulfate	n.d.	0.002	0.1
4,4'-Methoxychlor	n.d.	0.01	0.50	Endrin	n.d.	0.004	0.1
Aldrin	n.d.	0.004	0.50	Endrin aldehyde	n.d.	0.004	0.1
Aroclor 1016	n.d.	0.08	0.01	Heptachlor	n.d.	0.006	0.05
Aroclor 1221	n.d.	0.1	0.01	Heptachlor epoxide	n.d.	0.005	0.05
Aroclor 1232	n.d.	0.1	0.01	alpha-Chlordane	n.d.	0.04	0.05
Aroclor 1242	n.d.	0.1	0.01	alpha-BHC	n.d.	0.001	0.05
Aroclor 1248	n.d.	0.08	0.01	beta- BHC	n.d.	0.005	0.05
Aroclor 1254	n.d.	0.05	0.01	delta-BHC	n.d.	0.005	0.05
Aroclor 1260	n.d.	0.1	0.01	gama-BHC (Lindane)	n.d.	0.001	0.05
Dieldrin	n.d.	0.001	0.01				

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PO/Proj. SPS-DEERID-001
DEER ISLAND ELUTRIATE
MONITORING EDXDEJ050311

Date Reported: 07/29/11
Date Received: 05/03/11
Date Sampled 05/03/11

Lab number: 1844694 **Sample ID:** ELUTRIATE IC-S5/CI-WI

Method: EPA 8081A/8082 **Units:** µg/L **Analyst:** spa **Date of Analysis:** 5/10/2011

Analysis	Level Found	Method Detection Limit	Reporting Limit	Analysis	Level Found	Method Detection Limit	Reporting Limit
4,4'-DDE	n.d.	0.003	0.10	Endosulfan I	n.d.	0.005	0.05
4,4'-DDD	n.d.	0.004	0.10	Endosulfan II	n.d.	0.003	0.1
4,4'-DDT	n.d.	0.009	0.10	Endosulfan sulfate	n.d.	0.002	0.1
4,4'-Methoxychlor	n.d.	0.01	0.50	Endrin	n.d.	0.004	0.1
Aldrin	n.d.	0.004	0.50	Endrin aldehyde	n.d.	0.004	0.1
Aroclor 1016	n.d.	0.08	0.01	Heptachlor	n.d.	0.006	0.05
Aroclor 1221	n.d.	0.1	0.01	Heptachlor epoxide	n.d.	0.005	0.05
Aroclor 1232	n.d.	0.1	0.01	alpha-Chlordane	n.d.	0.04	0.05
Aroclor 1242	n.d.	0.1	0.01	alpha-BHC	n.d.	0.001	0.05
Aroclor 1248	n.d.	0.08	0.01	beta- BHC	n.d.	0.005	0.05
Aroclor 1254	n.d.	0.05	0.01	delta-BHC	n.d.	0.005	0.05
Aroclor 1260	n.d.	0.1	0.01	gama-BHC (Lindane)	n.d.	0.001	0.05
Dieldrin	n.d.	0.002	0.01				

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REPORT OF ANALYSIS

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PO/Proj. SPS-DEERID-001
DEER ISLAND ELUTRIATE
MONITORING EDXDEJ050311

Date Reported: 07/29/11
Date Received: 05/03/11
Date Sampled 05/03/11

LOW LEVEL ANALYSIS

Lab number: 1844691 **Sample ID:** IC-W1 MISSOURI RIVER OVERBURDEN WATER

Method: EPA 8081A/8082 **Units:** µg/L **Date of Analysis:** 5/10/2011

Analysis	Level Found	Method Detection Limit	Reporting Limit
Aroclor 1016	n.d.	0.0002	0.0009
Aroclor 1221	n.d.	0.0003	0.0009
Aroclor 1232	n.d.	0.0003	0.0009
Aroclor 1242	n.d.	0.0003	0.0009
Aroclor 1248	n.d.	0.0003	0.0009
Aroclor 1254	n.d.	0.0003	0.0009
Aroclor 1260	n.d.	0.0003	0.0009
Dieldrin	n.d.	0.0002	0.0009

* This Low level analysis was done by Corps of Engineers lab (USACE-ERDC-EPC) in Vicksburg MS.

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REPORT OF ANALYSIS

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PO/Proj. SPS-DEERID-001
DEER ISLAND ELUTRIATE
MONITORING EDXDEJ050311

Date Reported: 07/29/11
Date Received: 05/03/11
Date Sampled 05/03/11

LOW LEVEL ANALYSIS

Lab number: 1844694 **Sample ID:** ELUTRIATE IC-S5

Method: EPA 8081A/8082 **Units:** µg/L **Date of Analysis:** 5/10/2011

Analysis	Level Found	Method Detection Limit	Reporting Limit
Aroclor 1016	n.d.	0.0002	0.0009
Aroclor 1221	n.d.	0.0003	0.0009
Aroclor 1232	n.d.	0.0003	0.0009
Aroclor 1242	n.d.	0.0003	0.0009
Aroclor 1248	n.d.	0.0003	0.0009
Aroclor 1254	n.d.	0.0003	0.0009
Aroclor 1260	n.d.	0.0003	0.0009
Dieldrin	n.d.	0.0002	0.0009

* This Low level analysis was done by Corps of Engineers lab (USACE-ERDC-EPC) in Vicksburg MS.

INDIAN CAVE ELUTRIATE SAMPLING

May 3, 2011

Bacteria Analyses of Collected Soil Samples

Report Number
11-129-2228

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For: (20061) US ARMY CORPS OF ENGINEERS
(000)995-2310

Date Reported: 09/09/11
Date Received: 05/03/11
Date Sampled: 05/03/11

DEER ISLAND ELUTRIATE
MONITORING

Lab number: 1844680 Sample ID: IC-S1

Analysis	Level Found	Units	Detection Limit	Method	Analyst-Date	Verified-Date
E. coli (MPN)	n.d.	mpn/g	0.3	FDA/BAM 8TH ED. CHAPTER 4	nfo-05/05	kej-05/06

Notes:
n.d. - Not Detected.

For questions contact

Heather Ramig
Client Service Representative
heather@midwestlabs.com (402) 829-9891

Report Number
11-129-2229

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For: (20061) US ARMY CORPS OF ENGINEERS
(000)995-2310

Date Reported: 09/09/11
Date Received: 05/03/11
Date Sampled: 05/03/11

DEER ISLAND ELUTRIATE
MONITORING

Lab number: 1844681 Sample ID: IC-S2

Analysis	Level Found	Units	Detection Limit	Method	Analyst-Date	Verified-Date
E. coli (MPN)	n.d.	mpn/g	0.3	FDA/BAM 8TH ED. CHAPTER 4	nfo-05/05	kej-05/06

Notes:
n.d. - Not Detected.

For questions contact

Heather Ramig
Client Service Representative
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Report Number
11-129-2230

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For: (20061) US ARMY CORPS OF ENGINEERS
(000)995-2310

Date Reported: 05/09/11
Date Received: 05/03/11
Date Sampled: 05/03/11

DEER ISLAND ELUTRIATE
MONITORING

Lab number: 1844682 Sample ID: IC-S3

Analysis	Level Found	Units	Detection Limit	Method	Analyst-Date	Verified-Date
E. coli (MPN)	n.d.	mpn/g	0.3	FDA/BAM 8TH ED. CHAPTER 4	nfo-05/05	kej-05/06

Notes:
n.d. - Not Detected.

For questions contact

Prem W. Arora

Prem Arora
Environmental Project Manager
prem@midwestlabs.com (402)829-9878

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For: (20061) US ARMY CORPS OF ENGINEERS
(000)995-2310

Date Reported: 05/09/11
Date Received: 05/03/11
Date Sampled: 05/03/11

DEER ISLAND ELUTRIATE
MONITORING

Lab number: 1844683 Sample ID: IC-S4

Analysis	Level Found	Units	Detection Limit	Method	Analyst-Date	Verified-Date
E. coli (MPN)	n.d.	mpn/g	0.3	FDA/BAM 8TH ED. CHAPTER 4	nfo-05/05	kej-05/06

Notes:
n.d. - Not Detected.

For questions contact

Prem Arora
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For: (20061) US ARMY CORPS OF ENGINEERS
(000)995-2310

Date Reported: 05/09/11
Date Received: 05/03/11
Date Sampled: 05/03/11

DEER ISLAND ELUTRIATE
MONITORING

Lab number: 1844684 Sample ID: IC-S5

Analysis	Level Found	Units	Detection Limit	Method	Analyst-Date	Verified-Date
E. coli (MPN)	n.d.	mpn/g	0.3	FDA/BAM 8TH ED. CHAPTER 4	nfo-05/05	kej-05/06

Notes:
n.d. - Not Detected.

For questions contact

Prem Arora
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ATTACHMENT 6.

Laboratory Report of 2013 Results for Analysis of Collected Sediment/Soil, Receiving Water, and Prepared Pre-Elutriate and Elutriate Samples at the Proposed Indian Cave State Park Shallow Water Habitat Site

Station	Date	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Aluminum (Dissolved)	<0.03	mg/L	U	EPA 200.7	2	0.03	0.1
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Aluminum (Dissolved)	<0.03	mg/L	U	EPA 200.7	2	0.03	0.1
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Aluminum (Dissolved)	<0.03	mg/L	U	EPA 200.7	2	0.03	0.1
IC-W1	25-Apr-13	RECEIVING WATER	Aluminum (Dissolved)	<0.03	mg/L	U	EPA 200.7	2	0.03	0.1
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Aluminum (Total)	4.76	mg/L		EPA 200.7	2	0.03	0.1
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Aluminum (Total)	8.96	mg/L		EPA 200.7	2	0.03	0.1
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Aluminum (Total)	6.29	mg/L		EPA 200.7	2	0.03	0.1
IC-S1A	25-Apr-13	PRE ELUTRIATE	Aluminum (Total)	2692	mg/L		EPA 200.7	5	0.08	0.25
IC-S1B	25-Apr-13	PRE ELUTRIATE	Aluminum (Total)	1329	mg/L		EPA 200.7	5	0.08	0.25
IC-S3	25-Apr-13	PRE ELUTRIATE	Aluminum (Total)	2261	mg/L		EPA 200.7	5	0.08	0.25
IC-W1	25-Apr-13	RECEIVING WATER	Aluminum (Total)	11.97	mg/L		EPA 200.7	1	0.02	0.05
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Ammonia as N	0.07	mg/L	J	SM 4500-NH3 G	1	0.02	0.1
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Ammonia as N	0.07	mg/L	J	SM 4500-NH3 G	1	0.02	0.1
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Ammonia as N	0.04	mg/L	J	SM 4500-NH3 G	1	0.02	0.1
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Ammonia as N	0.07	mg/L	J	SM 4500-NH3 G	1	0.02	0.1
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Ammonia as N	0.08	mg/L	J	SM 4500-NH3 G	1	0.02	0.1
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Ammonia as N	0.05	mg/L	J	SM 4500-NH3 G	1	0.02	0.1
IC-S1A	25-Apr-13	PRE ELUTRIATE	Ammonia as N	<0.10	mg/L		SM 4500-NH3 C-1997	5	0.1	0.5
IC-S1B	25-Apr-13	PRE ELUTRIATE	Ammonia as N	<0.10	mg/L		SM 4500-NH3 C-1997	5	0.1	0.5
IC-S3	25-Apr-13	PRE ELUTRIATE	Ammonia as N	<0.10	mg/L		SM 4500-NH3 C-1997	5	0.1	0.5
IC-W1	25-Apr-13	RECEIVING WATER	Ammonia as N	0.14	mg/L		SM 4500-NH3 G	1	0.02	0.1
IC-S1A	25-Apr-13	SEDIMENT	Ammonia as N	1.9	mg/kg dry		SM 4500-NH3 G	5		1.3
IC-S1B	25-Apr-13	SEDIMENT	Ammonia as N	1.4	mg/kg dry		SM 4500-NH3 G	5		1.2
IC-S3	25-Apr-13	SEDIMENT	Ammonia as N	2.1	mg/kg dry		SM 4500-NH3 G	5		1.5
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Antimony (Dissolved)	0.0013	mg/L		EPA 200.8	2	0.00006	0.001
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Antimony (Dissolved)	0.0007	mg/L	J	EPA 200.8	2	0.00006	0.001
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Antimony (Dissolved)	0.0007	mg/L	J	EPA 200.8	2	0.00006	0.001
IC-W1	25-Apr-13	RECEIVING WATER	Antimony (Dissolved)	0.0012	mg/L		EPA 200.8	2	0.00006	0.001
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Antimony (Total)	<0.0000300	mg/L	U	EPA 200.8	1	0.00003	0.0005
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Antimony (Total)	<0.0000300	mg/L	U	EPA 200.8	1	0.00003	0.0005
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Antimony (Total)	<0.0000300	mg/L	U	EPA 200.8	1	0.00003	0.0005
IC-S1A	25-Apr-13	PRE ELUTRIATE	Antimony (Total)	0.0009	mg/L	J	EPA 200.8	5	0.0002	0.0025
IC-S1B	25-Apr-13	PRE ELUTRIATE	Antimony (Total)	<0.0002	mg/L	U	EPA 200.8	5	0.0002	0.0025
IC-S3	25-Apr-13	PRE ELUTRIATE	Antimony (Total)	0.0004	mg/L	J	EPA 200.8	5	0.0002	0.0025
IC-W1	25-Apr-13	RECEIVING WATER	Antimony (Total)	0.0006	mg/L		EPA 200.8	1	0.00003	0.0005
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Arsenic (Dissolved)	<0.0003	mg/L	U	EPA 200.8	2	0.0003	0.002
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Arsenic (Dissolved)	<0.0003	mg/L	U	EPA 200.8	2	0.0003	0.002
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Arsenic (Dissolved)	<0.0003	mg/L	U	EPA 200.8	2	0.0003	0.002
IC-W1	25-Apr-13	RECEIVING WATER	Arsenic (Dissolved)	<0.0003	mg/L	U	EPA 200.8	2	0.0003	0.002
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Arsenic (Total)	0.0009	mg/L	J	EPA 200.8	1	0.0002	0.001
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Arsenic (Total)	0.003	mg/L		EPA 200.8	1	0.0002	0.001
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Arsenic (Total)	0.001	mg/L		EPA 200.8	1	0.0002	0.001
IC-S1A	25-Apr-13	PRE ELUTRIATE	Arsenic (Total)	1.06	mg/L		EPA 200.8	5	0.0008	0.005
IC-S1B	25-Apr-13	PRE ELUTRIATE	Arsenic (Total)	0.669	mg/L		EPA 200.8	5	0.0008	0.005
IC-S3	25-Apr-13	PRE ELUTRIATE	Arsenic (Total)	0.919	mg/L		EPA 200.8	5	0.0008	0.005

Station	Date	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
IC-W1	25-Apr-13	RECEIVING WATER	Arsenic (Total)	0.006	mg/L		EPA 200.8	1	0.0002	0.001
IC-S1A	25-Apr-13	SEDIMENT	Arsenic (Total)	6.6	mg/kg dry		EPA 6020	100	0.01	0.6
IC-S1B	25-Apr-13	SEDIMENT	Arsenic (Total)	10.4	mg/kg dry		EPA 6020	100	0.01	0.6
IC-S3	25-Apr-13	SEDIMENT	Arsenic (Total)	7.1	mg/kg dry		EPA 6020	100	0.01	0.7
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Atrazine	0.15	ug/L	J	NEP	1.04167	0.08	0.5
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Atrazine	0.18	ug/L	J	NEP	1.17647	0.08	0.5
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Atrazine	0.15	ug/L	J	NEP	1.03093	0.08	0.5
IC-W1	25-Apr-13	RECEIVING WATER	Atrazine	0.28	ug/L	J	NEP	1.07527	0.08	0.5
IC-S1A	25-Apr-13	SEDIMENT	Atrazine	<0.002	ug/g	U	NEP	100	0.002	0.05
IC-S1B	25-Apr-13	SEDIMENT	Atrazine	<0.002	ug/g	U	NEP	1	0.002	0.05
IC-S3	25-Apr-13	SEDIMENT	Atrazine	<0.002	ug/g	U	NEP	1	0.002	0.05
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Beryllium (Dissolved)	0.001	mg/L	J	EPA 200.7	2	0.0004	0.002
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Beryllium (Dissolved)	<0.0004	mg/L	U	EPA 200.7	2	0.0004	0.002
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Beryllium (Dissolved)	<0.0004	mg/L	U	EPA 200.7	2	0.0004	0.002
IC-W1	25-Apr-13	RECEIVING WATER	Beryllium (Dissolved)	<0.0004	mg/L	U	EPA 200.7	2	0.0004	0.002
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Beryllium (Total)	<0.0004	mg/L	U	EPA 200.7	2	0.0004	0.002
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Beryllium (Total)	<0.0004	mg/L	U	EPA 200.7	2	0.0004	0.002
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Beryllium (Total)	<0.0004	mg/L	U	EPA 200.7	2	0.0004	0.002
IC-S1A	25-Apr-13	PRE ELUTRIATE	Beryllium (Total)	0.122	mg/L		EPA 200.7	5	0.001	0.005
IC-S1B	25-Apr-13	PRE ELUTRIATE	Beryllium (Total)	0.061	mg/L		EPA 200.7	5	0.001	0.005
IC-S3	25-Apr-13	PRE ELUTRIATE	Beryllium (Total)	0.102	mg/L		EPA 200.7	5	0.001	0.005
IC-W1	25-Apr-13	RECEIVING WATER	Beryllium (Total)	0.0004	mg/L	J	EPA 200.7	1	0.0002	0.001
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Cadmium (Dissolved)	0.0006	mg/L	J	EPA 200.8	2	0.00002	0.001
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Cadmium (Dissolved)	0.0005	mg/L	J	EPA 200.8	2	0.00002	0.001
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Cadmium (Dissolved)	0.0005	mg/L	J	EPA 200.8	2	0.00002	0.001
IC-W1	25-Apr-13	RECEIVING WATER	Cadmium (Dissolved)	0.0005	mg/L	J	EPA 200.8	2	0.00002	0.001
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Cadmium (Total)	0.0003	mg/L	J	EPA 200.8	1	0.00001	0.0005
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Cadmium (Total)	0.0003	mg/L	J	EPA 200.8	1	0.00001	0.0005
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Cadmium (Total)	0.0004	mg/L	J	EPA 200.8	1	0.00001	0.0005
IC-S1A	25-Apr-13	PRE ELUTRIATE	Cadmium (Total)	0.0769	mg/L		EPA 200.8	5	0.00005	0.0025
IC-S1B	25-Apr-13	PRE ELUTRIATE	Cadmium (Total)	0.0294	mg/L		EPA 200.8	5	0.00005	0.0025
IC-S3	25-Apr-13	PRE ELUTRIATE	Cadmium (Total)	0.0715	mg/L		EPA 200.8	5	0.00005	0.0025
IC-W1	25-Apr-13	RECEIVING WATER	Cadmium (Total)	0.0006	mg/L		EPA 200.8	1	0.00001	0.0005
IC-S1A	25-Apr-13	SEDIMENT	Cadmium (Total)	0.37	mg/kg dry		EPA 6020	100	0.003	0.06
IC-S1B	25-Apr-13	SEDIMENT	Cadmium (Total)	0.48	mg/kg dry		EPA 6020	100	0.003	0.06
IC-S3	25-Apr-13	SEDIMENT	Cadmium (Total)	0.45	mg/kg dry		EPA 6020	100	0.003	0.07
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Calcium (Dissolved)	96.23	mg/L		EPA 200.7	2	0.14	0.2
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Calcium (Dissolved)	92.89	mg/L		EPA 200.7	2	0.14	0.2
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Calcium (Dissolved)	88.63	mg/L		EPA 200.7	2	0.14	0.2
IC-W1	25-Apr-13	RECEIVING WATER	Calcium (Dissolved)	71.62	mg/L		EPA 200.7	2	0.14	0.2
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Calcium (Total)	96.1	mg/L		EPA 200.7	2	0.14	0.2
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Calcium (Total)	95.11	mg/L		EPA 200.7	2	0.14	0.2
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Calcium (Total)	83.86	mg/L		EPA 200.7	2	0.14	0.2
IC-S1B	25-Apr-13	PRE ELUTRIATE	Calcium (Total)	920.5	mg/L		EPA 200.7	5	0.35	0.5
IC-S3	25-Apr-13	PRE ELUTRIATE	Calcium (Total)	1203	mg/L		EPA 200.7	5	0.35	0.5

Station	Date	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
IC-S1A	25-Apr-13	PRE ELUTRIATE	Calcium (Total)	1734	mg/L		EPA 200.7	5	0.35	0.5
IC-W1	25-Apr-13	RECEIVING WATER	Calcium (Total)	78.03	mg/L		EPA 200.7	1	0.07	0.1
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Carbonaceous BOD	2	mg/L	J	SM 5210 B-2001	1	0.6	2
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Carbonaceous BOD	2	mg/L	J	SM 5210 B-2001	1	0.6	2
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Carbonaceous BOD	2	mg/L	J	SM 5210 B-2001	1	0.6	2
IC-S1A	25-Apr-13	PRE ELUTRIATE	Carbonaceous BOD	6	mg/L		SM 5210 B-2001	1	0.6	2
IC-S1B	25-Apr-13	PRE ELUTRIATE	Carbonaceous BOD	3	mg/L		SM 5210 B-2001	1	0.6	2
IC-S3	25-Apr-13	PRE ELUTRIATE	Carbonaceous BOD	3	mg/L		SM 5210 B-2001	1	0.6	2
IC-W1	25-Apr-13	RECEIVING WATER	Carbonaceous BOD	2	mg/L		SM 5210 B-2001	1	0.6	2
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Chemical Oxygen Demand	13	mg/L		ASTM D1252-95-B	1	2	5
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Chemical Oxygen Demand	5	mg/L		ASTM D1252-95-B	1	2	5
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Chemical Oxygen Demand	9	mg/L		ASTM D1252-95-B	1	2	5
IC-S1A	25-Apr-13	PRE ELUTRIATE	Chemical Oxygen Demand	3350	mg/L		ASTM D1252-95-B	25	47	125
IC-S1B	25-Apr-13	PRE ELUTRIATE	Chemical Oxygen Demand	1600	mg/L		ASTM D1252-95-B	25	47	125
IC-S3	25-Apr-13	PRE ELUTRIATE	Chemical Oxygen Demand	3420	mg/L		ASTM D1252-95-B	25	47	125
IC-W1	25-Apr-13	RECEIVING WATER	Chemical Oxygen Demand	14	mg/L		ASTM D1252-95-B	1	2	5
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Chromium (Dissolved)	<0.002	mg/L	U	EPA 200.7	2	0.002	0.02
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Chromium (Dissolved)	<0.002	mg/L	U	EPA 200.7	2	0.002	0.02
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Chromium (Dissolved)	<0.002	mg/L	U	EPA 200.7	2	0.002	0.02
IC-W1	25-Apr-13	RECEIVING WATER	Chromium (Dissolved)	<0.002	mg/L	U	EPA 200.7	2	0.002	0.02
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Chromium (Total)	0.003	mg/L	J	EPA 200.7	2	0.002	0.02
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Chromium (Total)	0.008	mg/L	J	EPA 200.7	2	0.002	0.02
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Chromium (Total)	0.005	mg/L	J	EPA 200.7	2	0.002	0.02
IC-S1A	25-Apr-13	PRE ELUTRIATE	Chromium (Total)	3.44	mg/L		EPA 200.7	5	0.005	0.05
IC-S1B	25-Apr-13	PRE ELUTRIATE	Chromium (Total)	1.66	mg/L		EPA 200.7	5	0.005	0.05
IC-S3	25-Apr-13	PRE ELUTRIATE	Chromium (Total)	2.66	mg/L		EPA 200.7	5	0.005	0.05
IC-W1	25-Apr-13	RECEIVING WATER	Chromium (Total)	0.01	mg/L		EPA 200.7	1	0.001	0.01
IC-S1A	25-Apr-13	SEDIMENT	Chromium (Total)	19.8	mg/kg dry		EPA 6010B	48.66	0.2	0.6
IC-S1B	25-Apr-13	SEDIMENT	Chromium (Total)	21.2	mg/kg dry		EPA 6010B	53.71	0.3	0.7
IC-S3	25-Apr-13	SEDIMENT	Chromium (Total)	20.3	mg/kg dry		EPA 6010B	54.73	0.3	0.8
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Copper (Dissolved)	0.006	mg/L	J	EPA 200.7	2	0.004	0.02
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Copper (Dissolved)	<0.004	mg/L	U	EPA 200.7	2	0.004	0.02
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Copper (Dissolved)	<0.004	mg/L	U	EPA 200.7	2	0.004	0.02
IC-W1	25-Apr-13	RECEIVING WATER	Copper (Dissolved)	0.007	mg/L	J	EPA 200.7	2	0.004	0.02
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Copper (Total)	0.01	mg/L	J	EPA 200.7	2	0.004	0.02
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Copper (Total)	0.02	mg/L	J	EPA 200.7	2	0.004	0.02
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Copper (Total)	0.04	mg/L		EPA 200.7	2	0.004	0.02
IC-S1A	25-Apr-13	PRE ELUTRIATE	Copper (Total)	3.18	mg/L		EPA 200.7	5	0.01	0.05
IC-S1B	25-Apr-13	PRE ELUTRIATE	Copper (Total)	1.58	mg/L		EPA 200.7	5	0.01	0.05
IC-S3	25-Apr-13	PRE ELUTRIATE	Copper (Total)	2.72	mg/L		EPA 200.7	5	0.01	0.05
IC-W1	25-Apr-13	RECEIVING WATER	Copper (Total)	0.02	mg/L		EPA 200.7	1	0.002	0.01
IC-S1A	25-Apr-13	SEDIMENT	Copper (Total)	17.5	mg/kg dry		EPA 6010B	48.66	0.08	0.6
IC-S1B	25-Apr-13	SEDIMENT	Copper (Total)	27.5	mg/kg dry		EPA 6010B	53.71	0.09	0.7
IC-S3	25-Apr-13	SEDIMENT	Copper (Total)	18.7	mg/kg dry		EPA 6010B	54.73	0.1	0.8
IC-S1	25-Apr-13	SEDIMENT	E. Coli	<0.3	MPN/g		FDA/BAM 8th Ed Chapter 4	1	0.3	0.3

Station	Date	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
IC-S2	25-Apr-13	SEDIMENT	E. Coli	<0.3	MPN/g		FDA/BAM 8th Ed Chapter 4	1	0.3	0.3
IC-S3	25-Apr-13	SEDIMENT	E. Coli	<0.3	MPN/g		FDA/BAM 8th Ed Chapter 4	1	0.3	0.3
IC-S4	25-Apr-13	SEDIMENT	E. Coli	<0.3	MPN/g		FDA/BAM 8th Ed Chapter 4	1	0.3	0.3
IC-S5	25-Apr-13	SEDIMENT	E. Coli	<0.3	MPN/g		FDA/BAM 8th Ed Chapter 4	1	0.3	0.3
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Iron (Dissolved)	0.05	mg/L	J	EPA 200.7	2	0.01	0.1
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Iron (Dissolved)	0.01	mg/L	J	EPA 200.7	2	0.01	0.1
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Iron (Dissolved)	0.01	mg/L	J	EPA 200.7	2	0.01	0.1
IC-W1	25-Apr-13	RECEIVING WATER	Iron (Dissolved)	0.03	mg/L	J	EPA 200.7	2	0.01	0.1
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Iron (Total)	5.35	mg/L		EPA 200.7	2	0.01	0.1
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Iron (Total)	8.54	mg/L		EPA 200.7	2	0.01	0.1
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Iron (Total)	6.34	mg/L		EPA 200.7	2	0.01	0.1
IC-S1A	25-Apr-13	PRE ELUTRIATE	Iron (Total)	4192	mg/L		EPA 200.7	50	0.25	2.5
IC-S1B	25-Apr-13	PRE ELUTRIATE	Iron (Total)	1921	mg/L		EPA 200.7	50	0.25	2.5
IC-S3	25-Apr-13	PRE ELUTRIATE	Iron (Total)	3159	mg/L		EPA 200.7	50	0.25	2.5
IC-W1	25-Apr-13	RECEIVING WATER	Iron (Total)	12	mg/L		EPA 200.7	1	0.005	0.05
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Lead (Dissolved)	0.6	ug/L		EPA 200.8	1	0.09	0.5
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Lead (Dissolved)	0.2	ug/L	J	EPA 200.8	1	0.09	0.5
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Lead (Dissolved)	0.4	ug/L	J	EPA 200.8	1	0.09	0.5
IC-W1	25-Apr-13	RECEIVING WATER	Lead (Dissolved)	0.6	ug/L		EPA 200.8	1	0.09	0.5
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Lead (Total)	3.2	ug/L		EPA 200.8	1	0.09	0.5
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Lead (Total)	5.1	ug/L		EPA 200.8	1	0.09	0.5
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Lead (Total)	3.1	ug/L		EPA 200.8	1	0.09	0.5
IC-S1A	25-Apr-13	PRE ELUTRIATE	Lead (Total)	2120	ug/L		EPA 200.8	1	0.09	0.5
IC-S1B	25-Apr-13	PRE ELUTRIATE	Lead (Total)	1035	ug/L		EPA 200.8	1	0.09	0.5
IC-S3	25-Apr-13	PRE ELUTRIATE	Lead (Total)	1738	ug/L		EPA 200.8	1	0.09	0.5
IC-W1	25-Apr-13	RECEIVING WATER	Lead (Total)	9	ug/L		EPA 200.8	1	0.09	0.5
IC-S1A	25-Apr-13	SEDIMENT	Lead (Total)	15	mg/kg dry		EPA 6010B	48.66	0.9	3
IC-S1B	25-Apr-13	SEDIMENT	Lead (Total)	14.6	mg/kg dry		EPA 6010B	53.71	1	3.3
IC-S3	25-Apr-13	SEDIMENT	Lead (Total)	14.4	mg/kg dry		EPA 6010B	54.73	1.2	4
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Magnesium (Dissolved)	19.24	mg/L		EPA 200.7	2	0.03	0.2
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Magnesium (Dissolved)	22.68	mg/L		EPA 200.7	2	0.03	0.2
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Magnesium (Dissolved)	20.92	mg/L		EPA 200.7	2	0.03	0.2
IC-W1	25-Apr-13	RECEIVING WATER	Magnesium (Dissolved)	23.59	mg/L		EPA 200.7	2	0.03	0.2
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Magnesium (Total)	19.96	mg/L		EPA 200.7	2	0.03	0.2
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Magnesium (Total)	24.62	mg/L		EPA 200.7	2	0.03	0.2
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Magnesium (Total)	19.73	mg/L		EPA 200.7	2	0.03	0.2
IC-S1B	25-Apr-13	PRE ELUTRIATE	Magnesium (Total)	518	mg/L		EPA 200.7	5	0.08	0.5
IC-S3	25-Apr-13	PRE ELUTRIATE	Magnesium (Total)	794.3	mg/L		EPA 200.7	5	0.08	0.5
IC-S1A	25-Apr-13	PRE ELUTRIATE	Magnesium (Total)	1062	mg/L		EPA 200.7	5	0.08	0.5
IC-W1	25-Apr-13	RECEIVING WATER	Magnesium (Total)	25.3	mg/L		EPA 200.7	1	0.02	0.1
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Manganese (Dissolved)	<0.004	mg/L	U	EPA 200.7	2	0.004	0.02
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Manganese (Dissolved)	<0.004	mg/L	U	EPA 200.7	2	0.004	0.02
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Manganese (Dissolved)	<0.004	mg/L	U	EPA 200.7	2	0.004	0.02
IC-W1	25-Apr-13	RECEIVING WATER	Manganese (Dissolved)	<0.004	mg/L	U	EPA 200.7	2	0.004	0.02
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Manganese (Total)	0.16	mg/L		EPA 200.7	2	0.004	0.02

Station	Date	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Manganese (Total)	0.16	mg/L		EPA 200.7	2	0.004	0.02
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Manganese (Total)	0.15	mg/L		EPA 200.7	2	0.004	0.02
IC-S1A	25-Apr-13	PRE ELUTRIATE	Manganese (Total)	136.4	mg/L		EPA 200.7	5	0.01	0.05
IC-S1B	25-Apr-13	PRE ELUTRIATE	Manganese (Total)	47.74	mg/L		EPA 200.7	5	0.01	0.05
IC-S3	25-Apr-13	PRE ELUTRIATE	Manganese (Total)	100.7	mg/L		EPA 200.7	5	0.01	0.05
IC-W1	25-Apr-13	RECEIVING WATER	Manganese (Total)	0.61	mg/L		EPA 200.7	1	0.002	0.01
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Mercury (Dissolved)	<0.0000080	mg/L	U	EPA 245.1	1	0.000008	0.0004
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Mercury (Dissolved)	<0.0000080	mg/L	U	EPA 245.1	1	0.000008	0.0004
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Mercury (Dissolved)	<0.0000080	mg/L	U	EPA 245.1	1	0.000008	0.0004
IC-W1	25-Apr-13	RECEIVING WATER	Mercury (Dissolved)	<0.0000080	mg/L	U	EPA 245.1	1	0.000008	0.0004
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Mercury (Total)	<0.0000080	mg/L	U	EPA 245.1	1	0.000008	0.0004
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Mercury (Total)	<0.0000080	mg/L	U	EPA 245.1	1	0.000008	0.0004
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Mercury (Total)	<0.0000080	mg/L	U	EPA 245.1	1	0.000008	0.0004
IC-S1A	25-Apr-13	PRE ELUTRIATE	Mercury (Total)	0.0043	mg/L		EPA 245.1	1	0.000008	0.0004
IC-S1B	25-Apr-13	PRE ELUTRIATE	Mercury (Total)	0.002	mg/L		EPA 245.1	1	0.000008	0.0004
IC-S3	25-Apr-13	PRE ELUTRIATE	Mercury (Total)	0.0035	mg/L		EPA 245.1	1	0.000008	0.0004
IC-W1	25-Apr-13	RECEIVING WATER	Mercury (Total)	<0.0000080	mg/L	U	EPA 245.1	1	0.000008	0.0004
IC-S1A	25-Apr-13	SEDIMENT	Mercury (Total)	0.02	mg/kg dry	J	EPA 7471	200	0.002	0.06
IC-S1B	25-Apr-13	SEDIMENT	Mercury (Total)	0.03	mg/kg dry	J	EPA 7471	200	0.002	0.06
IC-S3	25-Apr-13	SEDIMENT	Mercury (Total)	0.03	mg/kg dry	J	EPA 7471	200	0.003	0.07
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Nickel (Dissolved)	0.01	mg/L	J	EPA 200.7	2	0.004	0.02
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Nickel (Dissolved)	0.007	mg/L	J	EPA 200.7	2	0.004	0.02
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Nickel (Dissolved)	0.01	mg/L	J	EPA 200.7	2	0.004	0.02
IC-W1	25-Apr-13	RECEIVING WATER	Nickel (Dissolved)	0.03	mg/L		EPA 200.7	2	0.004	0.02
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Nickel (Total)	0.02	mg/L	J	EPA 200.7	2	0.004	0.02
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Nickel (Total)	0.02	mg/L	J	EPA 200.7	2	0.004	0.02
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Nickel (Total)	0.03	mg/L		EPA 200.7	2	0.004	0.02
IC-S1A	25-Apr-13	PRE ELUTRIATE	Nickel (Total)	4.23	mg/L		EPA 200.7	5	0.01	0.05
IC-S1B	25-Apr-13	PRE ELUTRIATE	Nickel (Total)	1.85	mg/L		EPA 200.7	5	0.01	0.05
IC-S3	25-Apr-13	PRE ELUTRIATE	Nickel (Total)	3.3	mg/L		EPA 200.7	5	0.01	0.05
IC-W1	25-Apr-13	RECEIVING WATER	Nickel (Total)	0.02	mg/L		EPA 200.7	1	0.002	0.01
IC-S1A	25-Apr-13	SEDIMENT	Nickel (Total)	22.6	mg/kg dry		EPA 6010B	48.66	0.2	0.6
IC-S1B	25-Apr-13	SEDIMENT	Nickel (Total)	23.8	mg/kg dry		EPA 6010B	53.71	0.2	0.7
IC-S3	25-Apr-13	SEDIMENT	Nickel (Total)	23.7	mg/kg dry		EPA 6010B	54.73	0.3	0.8
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Nitrate/Nitrite Nitrogen	2.38	mg/L		EPA 353.2	1	0.02	0.2
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Nitrate/Nitrite Nitrogen	2.36	mg/L		EPA 353.2	1	0.02	0.2
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Nitrate/Nitrite Nitrogen	3.6	mg/L		EPA 353.2	1	0.02	0.2
IC-S1A	25-Apr-13	PRE ELUTRIATE	Nitrate/Nitrite Nitrogen	3.08	mg/L		EPA 353.2	1	0.02	0.2
IC-S1B	25-Apr-13	PRE ELUTRIATE	Nitrate/Nitrite Nitrogen	2.77	mg/L		EPA 353.2	1	0.02	0.2
IC-S3	25-Apr-13	PRE ELUTRIATE	Nitrate/Nitrite Nitrogen	4.21	mg/L		EPA 353.2	1	0.02	0.2
IC-W1	25-Apr-13	RECEIVING WATER	Nitrate/Nitrite Nitrogen	2.1	mg/L		EPA 353.2	1	0.02	0.2
IC-S1A	25-Apr-13	SEDIMENT	Nitrate/Nitrite Nitrogen	2.2	mg/kg dry		EPA 353.2	5	0.04	1.3
IC-S1B	25-Apr-13	SEDIMENT	Nitrate/Nitrite Nitrogen	2.2	mg/kg dry		EPA 353.2	5	0.04	1.2
IC-S3	25-Apr-13	SEDIMENT	Nitrate/Nitrite Nitrogen	6.2	mg/kg dry	U	EPA 353.2	5	0.05	1.5
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Orthophosphate (Dissolved)	0.04	mg/L	J	SM 4500-P G-1999	1	0.005	0.05

Station	Date	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Orthophosphate (Dissolved)	0.03	mg/L	J	SM 4500-P G-1999	1	0.005	0.05
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Orthophosphate (Dissolved)	0.07	mg/L		SM 4500-P G-1999	1	0.005	0.05
IC-W1	25-Apr-13	RECEIVING WATER	Orthophosphate (Dissolved)	0.12	mg/L		SM 4500-P G-1999	1	0.005	0.05
IC-S1A	25-Apr-13	SEDIMENT	Percent Solids	79.94	%		SM 2540 G	1	0.01	0.01
IC-S1B	25-Apr-13	SEDIMENT	Percent Solids	80.69	%		SM 2540 G	1	0.01	0.01
IC-S3	25-Apr-13	SEDIMENT	Percent Solids	68.59	%		SM 2540 G	1	0.01	0.01
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	pH	7.82	S.U.		SM 4500-H B-2000	1		
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	pH	7.8	S.U.		SM 4500-H B-2000	1		
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	pH	7.49	S.U.		SM 4500-H B-2000	1		
IC-S1A	25-Apr-13	PRE ELUTRIATE	pH	7.57	S.U.		SM 4500-H B-2000	1		
IC-S1B	25-Apr-13	PRE ELUTRIATE	pH	7.74	S.U.		SM 4500-H B-2000	1		
IC-S3	25-Apr-13	PRE ELUTRIATE	pH	7.43	S.U.		SM 4500-H B-2000	1		
IC-W1	25-Apr-13	RECEIVING WATER	pH	8.13	S.U.		SM 4500-H B-2000	1		
IC-S1A	25-Apr-13	SEDIMENT	pH	7.55	S.U.		EPA 9045	1		
IC-S1B	25-Apr-13	SEDIMENT	pH	7.66	S.U.		EPA 9045	1		
IC-S3	25-Apr-13	SEDIMENT	pH	7.45	S.U.		EPA 9045	1		
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Phosphorus (Total Dissolved)	0.05	mg/L	J	SM 4500-P H-1999	1	0.008	0.05
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Phosphorus (Total Dissolved)	0.04	mg/L	J	SM 4500-P H-1999	1	0.008	0.05
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Phosphorus (Total Dissolved)	0.07	mg/L		SM 4500-P H-1999	1	0.008	0.05
IC-W1	25-Apr-13	RECEIVING WATER	Phosphorus (Total Dissolved)	0.12	mg/L		SM 4500-P H-1999	1	0.008	0.05
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Phosphorus (Total)	0.18	mg/L		SM 4500-P H-1999	1	0.008	0.05
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Phosphorus (Total)	0.23	mg/L		SM 4500-P H-1999	1	0.008	0.05
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Phosphorus (Total)	0.26	mg/L		SM 4500-P H-1999	1	0.008	0.05
IC-S1A	25-Apr-13	PRE ELUTRIATE	Phosphorus (Total)	94.8	mg/L		SM 4500-P H-1999	50	0.4	2.5
IC-S1B	25-Apr-13	PRE ELUTRIATE	Phosphorus (Total)	38.5	mg/L		SM 4500-P H-1999	50	0.4	2.5
IC-S3	25-Apr-13	PRE ELUTRIATE	Phosphorus (Total)	83.8	mg/L		SM 4500-P H-1999	50	0.4	2.5
IC-W1	25-Apr-13	RECEIVING WATER	Phosphorus (Total)	0.55	mg/L		SM 4500-P H-1999	1	0.008	0.05
IC-S1A	25-Apr-13	SEDIMENT	Phosphorus (Total)	653.9	mg/kg dry		EPA 6010B	48.66	1	6.1
IC-S1B	25-Apr-13	SEDIMENT	Phosphorus (Total)	673.5	mg/kg dry		EPA 6010B	53.71	1.1	6.7
IC-S3	25-Apr-13	SEDIMENT	Phosphorus (Total)	757.2	mg/kg dry		EPA 6010B	54.73	1.4	8
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Selenium (Dissolved)	0.006	mg/L		EPA 200.8	2	0.0007	0.002
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Selenium (Dissolved)	0.013	mg/L		EPA 200.8	2	0.0007	0.002
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Selenium (Dissolved)	0.006	mg/L		EPA 200.8	2	0.0007	0.002
IC-W1	25-Apr-13	RECEIVING WATER	Selenium (Dissolved)	0.003	mg/L		EPA 200.8	2	0.0007	0.002
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Selenium (Total)	0.007	mg/L		EPA 200.8	1	0.0004	0.001
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Selenium (Total)	0.014	mg/L		EPA 200.8	1	0.0004	0.001
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Selenium (Total)	0.004	mg/L		EPA 200.8	1	0.0004	0.001
IC-S1A	25-Apr-13	PRE ELUTRIATE	Selenium (Total)	0.094	mg/L		EPA 200.8	5	0.002	0.005
IC-S1B	25-Apr-13	PRE ELUTRIATE	Selenium (Total)	0.059	mg/L		EPA 200.8	5	0.002	0.005
IC-S3	25-Apr-13	PRE ELUTRIATE	Selenium (Total)	0.082	mg/L		EPA 200.8	5	0.002	0.005
IC-W1	25-Apr-13	RECEIVING WATER	Selenium (Total)	0.005	mg/L		EPA 200.8	1	0.0004	0.001
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Silver (Dissolved)	<0.004	mg/L	U	EPA 200.7	2	0.004	0.02
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Silver (Dissolved)	<0.004	mg/L	U	EPA 200.7	2	0.004	0.02
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Silver (Dissolved)	<0.004	mg/L	U	EPA 200.7	2	0.004	0.02
IC-W1	25-Apr-13	RECEIVING WATER	Silver (Dissolved)	<0.004	mg/L	U	EPA 200.7	2	0.004	0.02

Station	Date	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Silver (Total)	<0.004	mg/L	U	EPA 200.7	2	0.004	0.02
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Silver (Total)	<0.004	mg/L	U	EPA 200.7	2	0.004	0.02
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Silver (Total)	<0.004	mg/L	U	EPA 200.7	2	0.004	0.02
IC-S1A	25-Apr-13	PRE ELUTRIATE	Silver (Total)	<0.01	mg/L	U	EPA 200.7	5	0.01	0.05
IC-S1B	25-Apr-13	PRE ELUTRIATE	Silver (Total)	<0.01	mg/L	U	EPA 200.7	5	0.01	0.05
IC-S3	25-Apr-13	PRE ELUTRIATE	Silver (Total)	<0.01	mg/L	U	EPA 200.7	5	0.01	0.05
IC-W1	25-Apr-13	RECEIVING WATER	Silver (Total)	<0.002	mg/L	U	EPA 200.7	1	0.002	0.01
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Thallium (Dissolved)	<0.005	ug/L		EPA 200.8	1	0.005	0.5
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Thallium (Dissolved)	<0.005	ug/L		EPA 200.8	1	0.005	0.5
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Thallium (Dissolved)	<0.005	ug/L		EPA 200.8	1	0.005	0.5
IC-W1	25-Apr-13	RECEIVING WATER	Thallium (Dissolved)	<0.005	ug/L		EPA 200.8	1	0.005	0.5
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Thallium (Total)	0.09	ug/L	J	EPA 200.8	1	0.005	0.5
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Thallium (Total)	0.1	ug/L	J	EPA 200.8	1	0.005	0.5
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Thallium (Total)	0.1	ug/L	J	EPA 200.8	1	0.005	0.5
IC-S1A	25-Apr-13	PRE ELUTRIATE	Thallium (Total)	39.8	ug/L		EPA 200.8	1	0.005	0.5
IC-S1B	25-Apr-13	PRE ELUTRIATE	Thallium (Total)	20.9	ug/L		EPA 200.8	1	0.005	0.5
IC-S3	25-Apr-13	PRE ELUTRIATE	Thallium (Total)	34.3	ug/L		EPA 200.8	1	0.005	0.5
IC-W1	25-Apr-13	RECEIVING WATER	Thallium (Total)	0.3	ug/L	J	EPA 200.8	1	0.005	0.5
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Total Kjeldahl Nitrogen	0.69	mg/L		PAI-DK 02	1	0.08	0.5
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Total Kjeldahl Nitrogen	0.83	mg/L		PAI-DK 02	1	0.08	0.5
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Total Kjeldahl Nitrogen	0.69	mg/L		PAI-DK 02	1	0.08	0.5
IC-S1A	25-Apr-13	PRE ELUTRIATE	Total Kjeldahl Nitrogen	160	mg/L		PAI-DK 02	25	2.12	12.5
IC-S1B	25-Apr-13	PRE ELUTRIATE	Total Kjeldahl Nitrogen	68.6	mg/L		PAI-DK 02	10	0.85	5
IC-S3	25-Apr-13	PRE ELUTRIATE	Total Kjeldahl Nitrogen	111	mg/L		PAI-DK 02	20	1.7	10
IC-W1	25-Apr-13	RECEIVING WATER	Total Kjeldahl Nitrogen	1.02	mg/L		PAI-DK 02	1	0.08	0.5
IC-S1A	25-Apr-13	SEDIMENT	Total Kjeldahl Nitrogen	657	mg/kg dry		PAI-DK 01	20	6.8	12.5
IC-S1B	25-Apr-13	SEDIMENT	Total Kjeldahl Nitrogen	802	mg/kg dry		PAI-DK 01	20	6.8	12.4
IC-S3	25-Apr-13	SEDIMENT	Total Kjeldahl Nitrogen	1000	mg/kg dry		PAI-DK 01	20	8	14.6
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Total Organic Carbon	5.2	mg/L		SM 5310 B-2000	1	0.3	1
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Total Organic Carbon	7.4	mg/L		SM 5310 B-2000	1	0.3	1
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Total Organic Carbon	6.1	mg/L		SM 5310 B-2000	1	0.3	1
IC-S1A	25-Apr-13	PRE ELUTRIATE	Total Organic Carbon	1550	mg/L		SM 5310 B-2000	1	0.3	1
IC-S1B	25-Apr-13	PRE ELUTRIATE	Total Organic Carbon	823	mg/L		SM 5310 B-2000	1	0.3	1
IC-S3	25-Apr-13	PRE ELUTRIATE	Total Organic Carbon	1510	mg/L		SM 5310 B-2000	1	0.3	1
IC-W1	25-Apr-13	RECEIVING WATER	Total Organic Carbon	4	mg/L		SM 5310 B-2000	1	0.3	1
IC-S1A	25-Apr-13	SEDIMENT	Total Organic Carbon	0.83	% dry		ASTM D5373-08(mod)	1	0.01	0.01
IC-S1B	25-Apr-13	SEDIMENT	Total Organic Carbon	0.99	% dry		ASTM D5373-08(mod)	1	0.01	0.01
IC-S3	25-Apr-13	SEDIMENT	Total Organic Carbon	0.97	% dry		ASTM D5373-08(mod)	1	0.01	0.01
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Total Suspended Solids	79	mg/L		SM 2540 D-1997	1	4	4
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Total Suspended Solids	95	mg/L		SM 2540 D-1997	1	4	4
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Total Suspended Solids	67	mg/L		SM 2540 D-1997	1	4	4
IC-S1A	25-Apr-13	PRE ELUTRIATE	Total Suspended Solids	444000	mg/L		SM 2540 D-1997	1	4	4
IC-S1B	25-Apr-13	PRE ELUTRIATE	Total Suspended Solids	147000	mg/L		SM 2540 D-1997	1	4	4
IC-S3	25-Apr-13	PRE ELUTRIATE	Total Suspended Solids	166000	mg/L		SM 2540 D-1997	1	4	4
IC-W1	25-Apr-13	RECEIVING WATER	Total Suspended Solids	210	mg/L		SM 2540 D-1997	1	4	4

Station	Date	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Turbidity	0.12	NTU		EPA 180.1	5	0.05	0.05
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Turbidity	0.111	NTU		EPA 180.1	5	0.05	0.05
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Turbidity	0.281	NTU		EPA 180.1	5	0.05	0.05
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Turbidity	70.7	NTU		EPA 180.1	1	0.01	0.01
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Turbidity	147	NTU		EPA 180.1	1	0.01	0.01
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Turbidity	115	NTU		EPA 180.1	1	0.01	0.01
IC-S1A	25-Apr-13	PRE ELUTRIATE	Turbidity	76900	NTU		EPA 180.1	1000000	10000	10000
IC-S1B	25-Apr-13	PRE ELUTRIATE	Turbidity	29600	NTU		EPA 180.1	1000000	10000	10000
IC-S3	25-Apr-13	PRE ELUTRIATE	Turbidity	54700	NTU		EPA 180.1	1000000	10000	10000
IC-W1	25-Apr-13	RECEIVING WATER	Turbidity	282	NTU		EPA 180.1	1000	10	10
IC-S1A	25-Apr-13	FILTERED ELUTRIATE	Zinc (Dissolved)	0.02	mg/L	J	EPA 200.7	2	0.004	0.02
IC-S1B	25-Apr-13	FILTERED ELUTRIATE	Zinc (Dissolved)	0.01	mg/L	J	EPA 200.7	2	0.004	0.02
IC-S3	25-Apr-13	FILTERED ELUTRIATE	Zinc (Dissolved)	0.01	mg/L	J	EPA 200.7	2	0.004	0.02
IC-W1	25-Apr-13	RECEIVING WATER	Zinc (Dissolved)	0.008	mg/L	J	EPA 200.7	2	0.004	0.02
IC-S1A	25-Apr-13	NON FILTERED ELUTRIATE	Zinc (Total)	0.05	mg/L		EPA 200.7	2	0.004	0.02
IC-S1B	25-Apr-13	NON FILTERED ELUTRIATE	Zinc (Total)	0.06	mg/L		EPA 200.7	2	0.004	0.02
IC-S3	25-Apr-13	NON FILTERED ELUTRIATE	Zinc (Total)	0.05	mg/L		EPA 200.7	2	0.004	0.02
IC-S1A	25-Apr-13	PRE ELUTRIATE	Zinc (Total)	12.77	mg/L		EPA 200.7	5	0.01	0.05
IC-S1B	25-Apr-13	PRE ELUTRIATE	Zinc (Total)	5.81	mg/L		EPA 200.7	5	0.01	0.05
IC-S3	25-Apr-13	PRE ELUTRIATE	Zinc (Total)	9.58	mg/L		EPA 200.7	5	0.01	0.05
IC-W1	25-Apr-13	RECEIVING WATER	Zinc (Total)	0.05	mg/L		EPA 200.7	1	0.002	0.01
IC-S1A	25-Apr-13	SEDIMENT	Zinc (Total)	69.9	mg/kg dry		EPA 6010B	48.66	0.2	0.6
IC-S1B	25-Apr-13	SEDIMENT	Zinc (Total)	75.9	mg/kg dry		EPA 6010B	53.71	0.3	0.7
IC-S3	25-Apr-13	SEDIMENT	Zinc (Total)	65.9	mg/kg dry		EPA 6010B	54.73	0.3	0.8
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	4,4'-DDD	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	4,4'-DDD	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	4,4'-DDD	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-W1	25-Apr-13	RECEIVING WATER	4,4'-DDD	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-S1A	25-Apr-13	SEDIMENT	4,4'-DDD	<1	ug/kg	U	EPA 8081	500	1	10
IC-S1B	25-Apr-13	SEDIMENT	4,4'-DDD	<1	ug/kg	U	EPA 8081	500	1	10
IC-S3	25-Apr-13	SEDIMENT	4,4'-DDD	<1	ug/kg	U	EPA 8081	500	1	10
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	4,4'-DDE	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	4,4'-DDE	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	4,4'-DDE	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-W1	25-Apr-13	RECEIVING WATER	4,4'-DDE	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-S1A	25-Apr-13	SEDIMENT	4,4'-DDE	<1	ug/kg	U	EPA 8081	500	1	10
IC-S1B	25-Apr-13	SEDIMENT	4,4'-DDE	<1	ug/kg	U	EPA 8081	500	1	10
IC-S3	25-Apr-13	SEDIMENT	4,4'-DDE	<1	ug/kg	U	EPA 8081	500	1	10
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	4,4'-DDT	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	4,4'-DDT	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	4,4'-DDT	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
IC-W1	25-Apr-13	RECEIVING WATER	4,4'-DDT	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
IC-S1A	25-Apr-13	SEDIMENT	4,4'-DDT	<3	ug/kg	U	EPA 8081	500	3	10
IC-S1B	25-Apr-13	SEDIMENT	4,4'-DDT	<3	ug/kg	U	EPA 8081	500	3	10
IC-S3	25-Apr-13	SEDIMENT	4,4'-DDT	<3	ug/kg	U	EPA 8081	500	3	10

Station	Date	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Aldrin	<0.006	ug/L	U	EPA 8081	5	0.006	0.5
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Aldrin	<0.006	ug/L	U	EPA 8081	5	0.006	0.5
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Aldrin	<0.006	ug/L	U	EPA 8081	5	0.006	0.5
IC-W1	25-Apr-13	RECEIVING WATER	Aldrin	<0.006	ug/L	U	EPA 8081	5	0.006	0.5
IC-S1A	25-Apr-13	SEDIMENT	Aldrin	<1	ug/kg	U	EPA 8081	500	1	5
IC-S1B	25-Apr-13	SEDIMENT	Aldrin	<1	ug/kg	U	EPA 8081	500	1	5
IC-S3	25-Apr-13	SEDIMENT	Aldrin	<1	ug/kg	U	EPA 8081	500	1	5
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	alpha-BHC	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	alpha-BHC	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	alpha-BHC	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-W1	25-Apr-13	RECEIVING WATER	alpha-BHC	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-S1A	25-Apr-13	SEDIMENT	alpha-BHC	<1	ug/kg	U	EPA 8081	500	1	5
IC-S1B	25-Apr-13	SEDIMENT	alpha-BHC	<1	ug/kg	U	EPA 8081	500	1	5
IC-S3	25-Apr-13	SEDIMENT	alpha-BHC	<1	ug/kg	U	EPA 8081	500	1	5
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	alpha-Chlordane	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	alpha-Chlordane	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	alpha-Chlordane	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-W1	25-Apr-13	RECEIVING WATER	alpha-Chlordane	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-S1A	25-Apr-13	SEDIMENT	alpha-Chlordane	<1	ug/kg	U	EPA 8081	500	1	5
IC-S1B	25-Apr-13	SEDIMENT	alpha-Chlordane	<1	ug/kg	U	EPA 8081	500	1	5
IC-S3	25-Apr-13	SEDIMENT	alpha-Chlordane	<1	ug/kg	U	EPA 8081	500	1	5
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1016	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1016	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1016	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-W1	25-Apr-13	RECEIVING WATER	Aroclor-1016	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1A	25-Apr-13	SEDIMENT	Aroclor-1016	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1B	25-Apr-13	SEDIMENT	Aroclor-1016	<54	ug/kg	U	EPA 8082	500	54	100
IC-S3	25-Apr-13	SEDIMENT	Aroclor-1016	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1221	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1221	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1221	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-W1	25-Apr-13	RECEIVING WATER	Aroclor-1221	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1A	25-Apr-13	SEDIMENT	Aroclor-1221	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1B	25-Apr-13	SEDIMENT	Aroclor-1221	<54	ug/kg	U	EPA 8082	500	54	100
IC-S3	25-Apr-13	SEDIMENT	Aroclor-1221	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1232	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1232	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1232	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-W1	25-Apr-13	RECEIVING WATER	Aroclor-1232	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1A	25-Apr-13	SEDIMENT	Aroclor-1232	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1B	25-Apr-13	SEDIMENT	Aroclor-1232	<54	ug/kg	U	EPA 8082	500	54	100
IC-S3	25-Apr-13	SEDIMENT	Aroclor-1232	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1242	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1242	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1242	<0.7	ug/L	U	EPA 8082	5	0.7	1

Station	Date	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
IC-W1	25-Apr-13	RECEIVING WATER	Aroclor-1242	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1A	25-Apr-13	SEDIMENT	Aroclor-1242	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1B	25-Apr-13	SEDIMENT	Aroclor-1242	<54	ug/kg	U	EPA 8082	500	54	100
IC-S3	25-Apr-13	SEDIMENT	Aroclor-1242	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1248	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1248	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1248	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-W1	25-Apr-13	RECEIVING WATER	Aroclor-1248	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1A	25-Apr-13	SEDIMENT	Aroclor-1248	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1B	25-Apr-13	SEDIMENT	Aroclor-1248	<54	ug/kg	U	EPA 8082	500	54	100
IC-S3	25-Apr-13	SEDIMENT	Aroclor-1248	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1254	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1254	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1254	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-W1	25-Apr-13	RECEIVING WATER	Aroclor-1254	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1A	25-Apr-13	SEDIMENT	Aroclor-1254	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1B	25-Apr-13	SEDIMENT	Aroclor-1254	<54	ug/kg	U	EPA 8082	500	54	100
IC-S3	25-Apr-13	SEDIMENT	Aroclor-1254	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1260	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1260	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1260	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-W1	25-Apr-13	RECEIVING WATER	Aroclor-1260	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1A	25-Apr-13	SEDIMENT	Aroclor-1260	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1B	25-Apr-13	SEDIMENT	Aroclor-1260	<54	ug/kg	U	EPA 8082	500	54	100
IC-S3	25-Apr-13	SEDIMENT	Aroclor-1260	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1262	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1262	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1262	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-W1	25-Apr-13	RECEIVING WATER	Aroclor-1262	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1A	25-Apr-13	SEDIMENT	Aroclor-1262	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1B	25-Apr-13	SEDIMENT	Aroclor-1262	<54	ug/kg	U	EPA 8082	500	54	100
IC-S3	25-Apr-13	SEDIMENT	Aroclor-1262	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1268	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1268	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Aroclor-1268	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-W1	25-Apr-13	RECEIVING WATER	Aroclor-1268	<0.7	ug/L	U	EPA 8082	5	0.7	1
IC-S1A	25-Apr-13	SEDIMENT	Aroclor-1268	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1B	25-Apr-13	SEDIMENT	Aroclor-1268	<54	ug/kg	U	EPA 8082	500	54	100
IC-S3	25-Apr-13	SEDIMENT	Aroclor-1268	<54	ug/kg	U	EPA 8082	500	54	100
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	beta-BHC	<0.003	ug/L	U	EPA 8081	5	0.003	0.05
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	beta-BHC	<0.003	ug/L	U	EPA 8081	5	0.003	0.05
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	beta-BHC	<0.003	ug/L	U	EPA 8081	5	0.003	0.05
IC-W1	25-Apr-13	RECEIVING WATER	beta-BHC	0.02	ug/L	J	EPA 8081	5	0.003	0.05
IC-S1A	25-Apr-13	SEDIMENT	beta-BHC	<5	ug/kg	U	EPA 8081	500	5	5
IC-S1B	25-Apr-13	SEDIMENT	beta-BHC	<5	ug/kg	U	EPA 8081	500	5	5

Station	Date	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
IC-S3	25-Apr-13	SEDIMENT	beta-BHC	<5	ug/kg	U	EPA 8081	500	5	5
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	delta-BHC	<0.02	ug/L	U	EPA 8081	5	0.02	0.05
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	delta-BHC	<0.02	ug/L	U	EPA 8081	5	0.02	0.05
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	delta-BHC	<0.02	ug/L	U	EPA 8081	5	0.02	0.05
IC-W1	25-Apr-13	RECEIVING WATER	delta-BHC	0.03	ug/L	J	EPA 8081	5	0.02	0.05
IC-S1A	25-Apr-13	SEDIMENT	delta-BHC	<1	ug/kg	U	EPA 8081	500	1	5
IC-S1B	25-Apr-13	SEDIMENT	delta-BHC	<1	ug/kg	U	EPA 8081	500	1	5
IC-S3	25-Apr-13	SEDIMENT	delta-BHC	<1	ug/kg	U	EPA 8081	500	1	5
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Dieldrin	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Dieldrin	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Dieldrin	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-W1	25-Apr-13	RECEIVING WATER	Dieldrin	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-S1A	25-Apr-13	SEDIMENT	Dieldrin	<1	ug/kg	U	EPA 8081	500	1	10
IC-S1B	25-Apr-13	SEDIMENT	Dieldrin	<1	ug/kg	U	EPA 8081	500	1	10
IC-S3	25-Apr-13	SEDIMENT	Dieldrin	<1	ug/kg	U	EPA 8081	500	1	10
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Endosulfan I	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Endosulfan I	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Endosulfan I	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-W1	25-Apr-13	RECEIVING WATER	Endosulfan I	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-S1A	25-Apr-13	SEDIMENT	Endosulfan I	<1	ug/kg	U	EPA 8081	500	1	5
IC-S1B	25-Apr-13	SEDIMENT	Endosulfan I	<1	ug/kg	U	EPA 8081	500	1	5
IC-S3	25-Apr-13	SEDIMENT	Endosulfan I	<1	ug/kg	U	EPA 8081	500	1	5
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Endosulfan II	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Endosulfan II	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Endosulfan II	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
IC-W1	25-Apr-13	RECEIVING WATER	Endosulfan II	0.003	ug/L	J	EPA 8081	5	0.003	0.1
IC-S1A	25-Apr-13	SEDIMENT	Endosulfan II	<1	ug/kg	U	EPA 8081	500	1	10
IC-S1B	25-Apr-13	SEDIMENT	Endosulfan II	<1	ug/kg	U	EPA 8081	500	1	10
IC-S3	25-Apr-13	SEDIMENT	Endosulfan II	<1	ug/kg	U	EPA 8081	500	1	10
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Endosulfan sulfate	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Endosulfan sulfate	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Endosulfan sulfate	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-W1	25-Apr-13	RECEIVING WATER	Endosulfan sulfate	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-S1A	25-Apr-13	SEDIMENT	Endosulfan sulfate	<1	ug/kg	U	EPA 8081	500	1	10
IC-S1B	25-Apr-13	SEDIMENT	Endosulfan sulfate	<1	ug/kg	U	EPA 8081	500	1	10
IC-S3	25-Apr-13	SEDIMENT	Endosulfan sulfate	<1	ug/kg	U	EPA 8081	500	1	10
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Endrin	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Endrin	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Endrin	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-W1	25-Apr-13	RECEIVING WATER	Endrin	0.006	ug/L	J	EPA 8081	5	0.004	0.1
IC-S1A	25-Apr-13	SEDIMENT	Endrin	<2	ug/kg	U	EPA 8081	500	2	10
IC-S1B	25-Apr-13	SEDIMENT	Endrin	<2	ug/kg	U	EPA 8081	500	2	10
IC-S3	25-Apr-13	SEDIMENT	Endrin	<2	ug/kg	U	EPA 8081	500	2	10
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Endrin aldehyde	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Endrin aldehyde	<0.004	ug/L	U	EPA 8081	5	0.004	0.1

Station	Date	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Endrin aldehyde	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-W1	25-Apr-13	RECEIVING WATER	Endrin aldehyde	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
IC-S1A	25-Apr-13	SEDIMENT	Endrin aldehyde	<3	ug/kg	U	EPA 8081	500	3	10
IC-S1B	25-Apr-13	SEDIMENT	Endrin aldehyde	<3	ug/kg	U	EPA 8081	500	3	10
IC-S3	25-Apr-13	SEDIMENT	Endrin aldehyde	<3	ug/kg	U	EPA 8081	500	3	10
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Endrin ketone	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Endrin ketone	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Endrin ketone	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
IC-W1	25-Apr-13	RECEIVING WATER	Endrin ketone	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
IC-S1A	25-Apr-13	SEDIMENT	Endrin ketone	<1	ug/kg	U	EPA 8081	500	1	10
IC-S1B	25-Apr-13	SEDIMENT	Endrin ketone	<1	ug/kg	U	EPA 8081	500	1	10
IC-S3	25-Apr-13	SEDIMENT	Endrin ketone	<1	ug/kg	U	EPA 8081	500	1	10
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	gamma-BHC (Lindane)	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	gamma-BHC (Lindane)	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	gamma-BHC (Lindane)	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-W1	25-Apr-13	RECEIVING WATER	gamma-BHC (Lindane)	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-S1A	25-Apr-13	SEDIMENT	gamma-BHC (Lindane)	<2	ug/kg	U	EPA 8081	500	2	5
IC-S1B	25-Apr-13	SEDIMENT	gamma-BHC (Lindane)	<2	ug/kg	U	EPA 8081	500	2	5
IC-S3	25-Apr-13	SEDIMENT	gamma-BHC (Lindane)	<2	ug/kg	U	EPA 8081	500	2	5
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	gamma-Chlordane	<0.005	ug/L	U	EPA 8081	5	0.005	0.05
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	gamma-Chlordane	<0.005	ug/L	U	EPA 8081	5	0.005	0.05
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	gamma-Chlordane	<0.005	ug/L	U	EPA 8081	5	0.005	0.05
IC-W1	25-Apr-13	RECEIVING WATER	gamma-Chlordane	<0.005	ug/L	U	EPA 8081	5	0.005	0.05
IC-S1A	25-Apr-13	SEDIMENT	gamma-Chlordane	<1	ug/kg	U	EPA 8081	500	1	5
IC-S1B	25-Apr-13	SEDIMENT	gamma-Chlordane	<1	ug/kg	U	EPA 8081	500	1	5
IC-S3	25-Apr-13	SEDIMENT	gamma-Chlordane	<1	ug/kg	U	EPA 8081	500	1	5
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Heptachlor	<0.005	ug/L	U	EPA 8081	5	0.005	0.05
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Heptachlor	<0.005	ug/L	U	EPA 8081	5	0.005	0.05
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Heptachlor	<0.005	ug/L	U	EPA 8081	5	0.005	0.05
IC-W1	25-Apr-13	RECEIVING WATER	Heptachlor	<0.005	ug/L	U	EPA 8081	5	0.005	0.05
IC-S1A	25-Apr-13	SEDIMENT	Heptachlor	<2	ug/kg	U	EPA 8081	500	2	5
IC-S1B	25-Apr-13	SEDIMENT	Heptachlor	<2	ug/kg	U	EPA 8081	500	2	5
IC-S3	25-Apr-13	SEDIMENT	Heptachlor	<2	ug/kg	U	EPA 8081	500	2	5
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Heptachlor Epoxide	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Heptachlor Epoxide	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Heptachlor Epoxide	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
IC-W1	25-Apr-13	RECEIVING WATER	Heptachlor Epoxide	0.007	ug/L	J	EPA 8081	5	0.004	0.05
IC-S1A	25-Apr-13	SEDIMENT	Heptachlor Epoxide	<1	ug/kg	U	EPA 8081	500	1	5
IC-S1B	25-Apr-13	SEDIMENT	Heptachlor Epoxide	<1	ug/kg	U	EPA 8081	500	1	5
IC-S3	25-Apr-13	SEDIMENT	Heptachlor Epoxide	<1	ug/kg	U	EPA 8081	500	1	5
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Methoxychlor	<0.004	ug/L	U	EPA 8081	5	0.004	0.5
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Methoxychlor	<0.004	ug/L	U	EPA 8081	5	0.004	0.5
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Methoxychlor	<0.004	ug/L	U	EPA 8081	5	0.004	0.5
IC-W1	25-Apr-13	RECEIVING WATER	Methoxychlor	<0.004	ug/L	U	EPA 8081	5	0.004	0.5
IC-S1A	25-Apr-13	SEDIMENT	Methoxychlor	<2	ug/kg	U	EPA 8081	500	2	50

Station	Date	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
IC-S1B	25-Apr-13	SEDIMENT	Methoxychlor	<2	ug/kg	U	EPA 8081	500	2	50
IC-S3	25-Apr-13	SEDIMENT	Methoxychlor	<2	ug/kg	U	EPA 8081	500	2	50
IC-S1A	26-Apr-13	NON FILTERED ELUTRIATE	Toxaphene	<0.1	ug/L	U	EPA 8081	5	0.1	5
IC-S1B	26-Apr-13	NON FILTERED ELUTRIATE	Toxaphene	<0.1	ug/L	U	EPA 8081	5	0.1	5
IC-S3	26-Apr-13	NON FILTERED ELUTRIATE	Toxaphene	<0.1	ug/L	U	EPA 8081	5	0.1	5
IC-W1	25-Apr-13	RECEIVING WATER	Toxaphene	<0.1	ug/L	U	EPA 8081	5	0.1	5
IC-S1A	25-Apr-13	SEDIMENT	Toxaphene	<273	ug/kg	U	EPA 8081	500	273	450
IC-S1B	25-Apr-13	SEDIMENT	Toxaphene	<273	ug/kg	U	EPA 8081	500	273	450
IC-S3	25-Apr-13	SEDIMENT	Toxaphene	<273	ug/kg	U	EPA 8081	500	273	450